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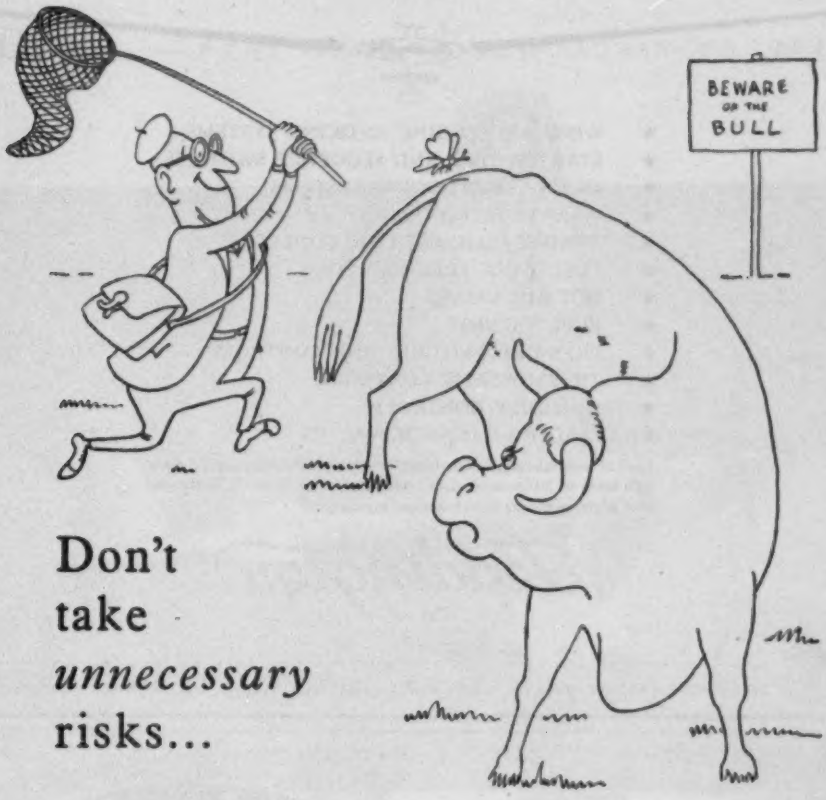


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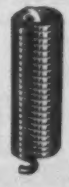

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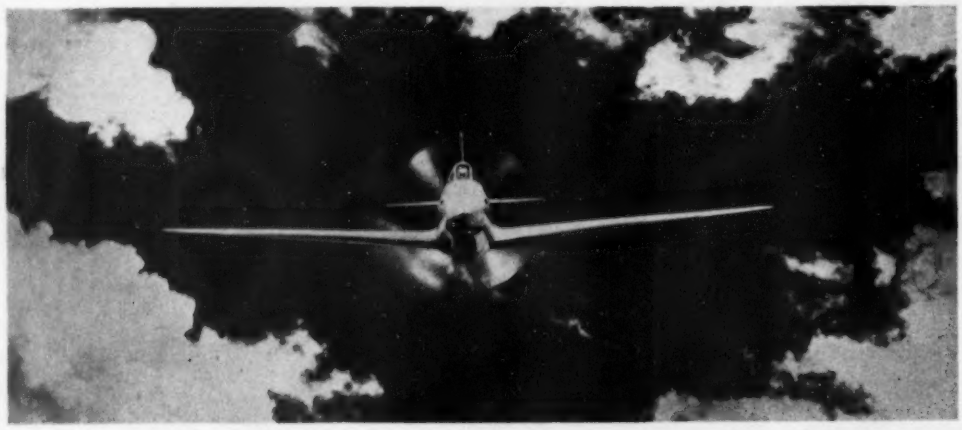

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# P.148

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## Brave Days of Old

TO our own minds (and we know that a great number of readers will concur) the crowning feature of this issue is the first part of another of our squadron histories. And in affirming this we are not unmindful of the important contributions on more topical matters such as rocket fuels and Corporation profits.

The appeal of *Flight's* squadron histories—indeed, of all our recent reviews of past achievements—is positively indicated by the amount of correspondence they have evoked, while the depth of interest is clearly apparent in the detailed nature of comments and criticism. In compiling the articles we have learned a great deal not only about the subjects immediately under review, but concerning the state of recorded knowledge in this country; and this, we have no hesitation in saying, gives little cause for satisfaction. Certainly we can never be sure, even after the most assiduous gleaning in all recognized archives, of achieving a definitive result, for so much of the nation's heritage is tucked away in drawers or diaries, or in minds which summon up remembrance less readily and less accurately as the years go by. Thus, in printing this week some reminiscences of Air Chief Marshal Sir Arthur Longmore, Air Marshal Sir John d'Albiac and Major Sydney Sippé we acknowledge a privilege and a duty.

We are aware that a number of small associations and individuals are engaged in collecting and consolidating historical data and that their papers are privately circulated; but limited in scope and lacking in cohesion as these bodies are, their studies must themselves be considered ephemeral. The records of aircraft constructors—and we state this with conviction—are in many instances incomplete and inaccurate, even in regard to the characteristics and accomplishments of the firms' own products, while the various museums and libraries officially concerned with British Service flying are, though unfailingly obliging, by no means omniscient. Moreover, ten minutes' inspection will prove that those well-conducted repositories of aeronautical material, the National Aeronautical Collection, Imperial War Museum, and the Museum of the R.U.S.I., are deficient in many important respects, due largely to restrictions on space.

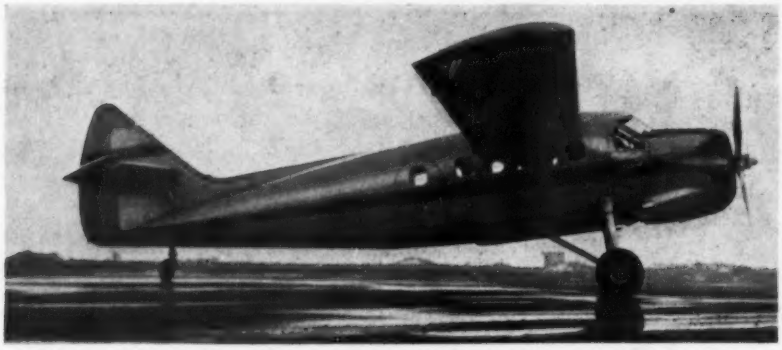
While the connoisseurs of old ships, naval traditions, uniforms, arms and military records have, for many years, had their own learned societies and have been served by admirable journals, nothing comparable has been attempted in the aeronautical field.

It might be argued that military aeronautics date back little more than forty years (though this view is in itself quite fallacious); but it is none the less apparent that posterity is already in process of losing many priceless memories and records, and to prevent this in some degree, pending the establishment of some society such as we have suggested, we shall continue with such researches as are possible in these changeful days.

## "Therefore, go forth . . ."

FAILURE of metals through fatigue is in one form or another familiar to everyone, but it remains an ever-present problem for the metallurgist as each new alloy brings a variation in physical properties, and because the fundamentals are imperfectly understood. Moreover, the vibrations in an aircraft structure which are responsible for fatigue emanate from a number of sources, and cannot as yet be precisely measured or estimated. The convincing Mr. Honey of Nevil Shute's *No Highway* indicated some of the parameters and gave far-from-fictitious information about fatigue problems; but whether his nuclear thesis will prove to have a factual basis remains to be seen.

Certain important airframe parts have now to be included with engines and other units as components requiring replacement after a given number of flying hours. The light alloys from which they are produced have advantageous weight and tensile-strength properties, but, in the sections they make possible, may be more prone to fatigue failure than earlier and less highly stressed materials. Two current types of British aircraft have been named by the licensing authorities in this connection, and a limit (with adequate safety margin) set upon the life of certain of their wing-spar components. Replacement will fall due after, say, four years in service, and passengers may rest assured that these measures will remove any possibility of structural failure.



*(Below) Close-up of the Otter's induced-flow engine cowling. The only cooling-air outlet is that from the ducts surrounding the exhaust tailpipes. The typical Hamilton-Standard blade shape of the cropped DC-3 airscrew is also noticeable. The external skin-stiffeners under the fuselage allow a clean inside skin for the three self-sealing fuel cells, the fillers for which are also visible.*

*This starboard-side view of the Otter emphasizes its main features: neat cowling of the Wasp engine; straight fuselage-lines, but with curved instead of flat panels; large fin area with long dorsal extension; and high-placed tailplane.*

# D.H. CANADA OTTER

## *Constructional Features and Air Impressions of the Dominion's Latest Aircraft*

By JAMES HAY STEVENS

**LAST week we published the first of a series of articles, by James Hay Stevens, on the Canadian Aircraft Industry; the next will appear in an early issue. Meanwhile we present here, from the pen of the same author, an appraisal of an outstanding new product of that industry.**

THE Otter is a remarkable aircraft, far more remarkable than its somewhat simple outlines would suggest. It is usually regarded rather as an enlarged Beaver, but it is very much more than this and is, in fact, an entirely new design by its makers, the de Havilland Aircraft of Canada, Ltd. It has been born out of experience with the Beaver, itself the epitome of a generation of practical bush flying, but apart from the adoption of a similar high-wing layout the two types have little in common.

Good as is the low-speed performance of the Beaver, the Otter was designed to better it and, in particular, to reverse an unusual characteristic of the former. The Beaver needs slightly more space for landing than for take-off and it was decided that the Otter must be able to enter any clearing it could leave. As the makers' provisional figures show, this objective has been attained and the landplane can be taken off in 400 yards over a 50ft obstacle in still air. Actually this figure gives no idea of the extraordinarily short run achieved under normal wind conditions, when the Otter just seems to waddle along for a few yards before lifting off and climbing away steeply.

The Otter—it is officially the DHC-3—was built to an R.C.A.F. specification and the prototype is being purchased at a price of around $630,000 (£225,000) after it has received its C. of A. to cover development costs. Thereafter, it is hoped to market at a basic price of about $65,000 (£23,210), plus $7,500 (£2,680) for floats and $1,800 (£642) for skis. On top of these figures one has to add, in Canada, a sales tax of 10 per cent or, in the U.S.A. an import duty of 15 per cent.

An output of six or eight Otters is envisaged during this year, rising to one a week by 1953. The second and third machines were well in hand in March and these have been sold to the Ontario Department of Lands and Forests—already owners of 41 Beavers. Envisaged from the bush experience of many people, including that of Mr. Phil Garratt, the company's managing director, the Otter was designed by Mr. R. D. Hiscocks under the general engineering direction of Mr. Douglas Hunter.

As with the Beaver, simplicity has been the keynote in the structural design. The flat fuselage-sides of the Beaver have given place to slightly curved panels in order to suppress "oil-canning." The resulting fuselage cross-section is particularly convenient for accommodating either passengers or bulky freight. The rear of the cabin has a door 30in wide in the starboard side and a 46-in double door in the port side. The cabin dimensions are deceptive, because the Otter looks so little larger than the Beaver. In point of fact, it is almost the same size as that of the Dove, being slightly wider and higher, a foot longer in the passenger section and a foot shorter overall from the cockpit bulkhead to the draughtproof rear bulkhead aft of the freight and radio compartments.

At the rear of the cabin is a 27-in dropping hatch. The cabin space can be used for 10 passengers (14 when using sideways seats and the second pilot's seat), six stretchers and four passengers, three stretchers and seven passengers, or for freight. The longitudinal skin-stiffeners under the front fuselage are there to give a smooth interior skin round the fuel cells mounted under the floor.

The wing structure is a simple one, with a main spar at 35 per cent chord, flanged blank ribs and stressed-skin covering. The spar is farther back than on the Beaver because it has to take the twisting loads imposed on the wing torsion-

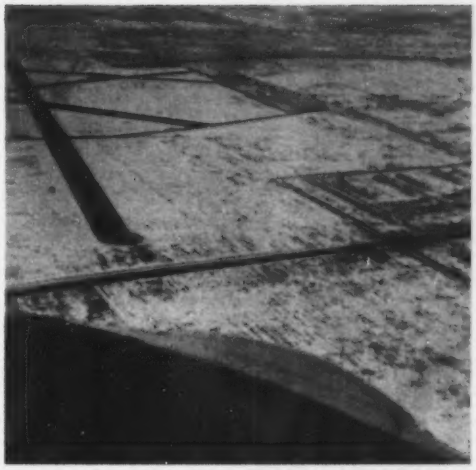
box by the double-slotted N.A.C.A. flaps. These flaps, which are still the subject of flight trials for optimum settings, are the reason for the outstanding low-speed performance. The forward flap, when fully down, is set at about 40 deg throughout the span, while the inner rear section is lowered another 30 deg; the ailerons remain at the same incidence as the main wing. The result of this is that the slotted ailerons retain effectiveness at the stall and their leading edges still give the drag necessary for preventing yaw.

Tail shape is dictated by the high-lift flaps, while large fin area and long dorsal extension maintain directional stability and control at low speed. The extension, incidentally, has had a sharp leading-edge added to suppress a tendency to premature breakaway. The tailplane is set high to clear the wing downwash and is adjustable over 12 deg. Again, this wide range is necessary because of the change of attitude with the large flaps; but the actual trim changes are not violent, because of the high position of the tail plane.

This combination of high-lift flaps and variable-incidence tailplane permits the unusually large c.g. range of 15 to 40 per cent M.A.C.—actually no less than 20in.

The ribbed control and flap surfaces are worth comment. These are similar to the construction that has proved itself well in the Beaver. A simple spar web and D-nose take the main loads and the control surface itself consists of two skins with vee-section corrugations taking the place of all but one or two ribs. A curious feature of these surfaces is that, although the ends of the corrugations are open, there seems to be no drag penalties or corrosion trouble. Incidentally, bush aircraft, which are seldom under cover, are given two internal coats and one external coat of zinc chromate beneath a protective paint.

Structural material on the Otter is mainly 24 ST, a duralumin-type alloy, with a few high-strength magnesium-alloy castings. During design, great care was taken with weight control and parallel work was done on a fuselage and wing combination in a structural-test "cathedral." Every attempt was made to "design light" and in general a first result of 90 per cent of the ultimate load was achieved. This was very satisfactory, since it was a simple matter to bring the weak points up to strength.



*This shot was taken as the pilot was making his final turn-in; it emphasizes the unusually good view and steep angle of approach.*

*Mr. George Neal, chief test pilot of de Havilland Aircraft of Canada, Ltd., at the controls of the Otter prototype.*

The undercarriage of the Otter remains faithful to the de Havilland rubber-block shock-absorber. As the Otter is heavier than the Beaver, the cantilever legs have been discarded in favour of a tripod layout. The unit consists of a long compression strut, a hinged rearward-sloping drag strut and a universally-jointed radius rod. The shock absorber strut has concentric sliding tubes with a central guide tube surrounded by compression rubbers—very much like an enlarged version of the original Moth leg. Ordinary rubber behaves badly at low temperatures, losing much of its resilience; but de Havillands are now trying a new rubber that retains its properties down to −40 deg F. They are also trying a new high-pressure lubricant to prevent friction between the rubbers and the leg tubes. This new material, a proprietary molybdenum sulphide compound called Molly-cote, will replace the more usual graphite preparations.

This new undercarriage should have sufficient energy-absorption for it to be used with skis without any additional springing, such as is usually necessary to replace tyre resilience. At the time of my visit de Havillands were hurrying to try some new lightweight Fibreglass skis before the spring thaw. Fibreglass should have lower friction than duralumin and would be less likely to freeze in—one of the problems of parking a skiplane.

Even the installation of the Wasp engine is misleading in appearance. It looks no more than a rather neat unit, but in fact it is a very carefully designed and tested induced-flow cowling. The geared engine is mounted *via* the cylinder heads on dynafocal rubbers in a steel-tube cradle attached to

(*Continued on page* 433)

*Three views of the Otter's double-slotted flaps. The final settings have not yet been decided, but these pictures give a good idea of their movement and method of operation.*

# FROM ALL QUARTERS

## The New Zealand Race

THE question of an official R.A.F. entry in the 1953 race to New Zealand is at present "under consideration," according to Mr. G. R. Ward, Under-Secretary of State for Air, in a Commons reply last week. Mr. John Grimston (Con., St. Albans) had stressed the very great international prestige attaching to the outcome of the race; he hoped that the Government would concentrate on getting "a good British entry."

There are both speed and handicap sections in this race, flight-refuelling being permitted in the former. The U.S.A.F. are considered certain entrants for the speed section, while a number of airlines are likely to enter under handicap rules; the de Havilland company have made a provisional entry in the latter section, in which the Avon-Comet would appear to be a strong competitor.

(Full details of the conditions of entry were given in *Flight* of February 1st, 1952, p. 117).

## "Zura" For Canada

BY the departure of S/L. Janusz Zurakowski to take up a post with Avro Canada, the Gloster Aircraft Co., Ltd., will lose a test and demonstration pilot of altogether exceptional ability. "Zura," who joined the R.A.F. in 1940, and from 1945-47 served at the A. and A.E.E., Boscombe Down, is due to leave, with his family within the next few days.

Readers will join us in extending to this fine Polish pilot all good wishes for his happiness and prosperity across the Atlantic. It is a consoling thought that he will remain under the broad canopy of the Hawker Siddeley group.

## Bristol 181 Helicopter

AT the annual dinner and dance of the Bristol Aeroplane Company's helicopter department last Friday, Mr. Raoul Hafner said that B.E.A. were showing great interest in the twin-rotor 173, but that in order to make the aircraft more economic, it would be necessary to increase the payload, which in turn meant increasing the all-up weight; to this end, stub-wings would be fitted. The Corporation's helicopter specification was a timely document, and Bristol's answer was the 181, a scaled-up design variant of the 173 and intended to carry 40 passengers.

B.E.A. would want to start operating the 181 by 1958. This meant that a C. of A. would have to be obtained by 1957, and, therefore test flying would have to be started in 1955. Mr. Hafner suggested, amidst laughter, that work on the new helicopter would have to start immediately after the dance.

## In The Commons

ANSWERING a suggestion that the Brabazon 1 prototype might be operated by B.E.A. on the London-Paris route during the coming tourist season, Mr. Gurney Braithwaite, Parliamentary Secretary to the M.C.A. said that future use of the Brabazon was still being discussed with the Ministry of Supply and B.E.A. It was apparent, he said, that the cost and technical difficulties of putting the "Brab" to commercial use were considerable and that its early introduction was impracticable.

Hopes for the revival of the Airmet Broadcasts were again dashed when Mr. L. D. Gammans, Assistant Postmaster-General, said that the B.B.C. did not propose to give up from its foreign service any wavelength suitable for reception in this country. The B.B.C. Home programme would have first claim if such a wavelength became available. In reply to Mr. Frank Beswick, who pointed out that it had been repeatedly stated that the only reason why a channel could not be made available for Airmet was because of requirements of the Foreign Office, Mr. Gammans stated that the Foreign Office services had not yet been reduced to the point where a wavelength could be relinquished. Mr. Beswick then suggested that Airmet could be broadcast on the Third-programme wavelength during non-operative hours; Mr. Gammans said that he would give a specific answer if this question were tabled.

*RADAR-EQUIPPED development of the Mig-15, with redesigned intake. Note, in this photograph (which has been retouched for clarity), the retractable tail bumper and the wide-track main undercarriage.*

## Canadian Post for Sir R. Watson-Watt

THE appointment of Sir Robert Watson-Watt as Adviser in Radar and Electronics to the Canadian Defence Research Board was announced last week by the Hon. Brooke Claxton, Canadian Minister of National Defence. Sir Robert, who is 60 years of age, has had an exceptionally distinguished career in science; his name is particularly well known, even outside scientific circles, in connection with his pioneer (and subsequent) work in developing the radar defences of this country. Early this year he was recommended by the Royal Commission on Awards to Inventors for a tax-free grant of £50,000. He has held important posts in the Air Ministry, the Department of Scientific and Industrial Research, and the Ministries of Aircraft Production, Supply, Transport and Civil Aviation; he is at present the President of the Royal Meteorological Society and has also been Scientific Adviser on Telecommunications at the M.C.A. since 1946. It is stated that his new appointment will not affect his governing directorship of Sir Robert Watson-Watt and Partners, Ltd.

*Sir Robert Watson-Watt*

## Mr. N. Rowbothom Resigns

FROM the Bristol Aeroplane Co., Ltd., comes the announcement that Mr. N. Rowbotham, C.B.E., has resigned his directorships of that company and of the associated firms of Rotol, Ltd., and S.E.C.A. (France).

It was announced last September that Mr. Rowbotham had, for reasons of health, relinquished his appointment as managing director of the Bristol engine division, but that he would remain a director.

## Reg Woodhams Goes to A.W.A.

AFTER several years as sales and service manager of the aircraft division of Air Service Training, Ltd., Mr. R. J. Woodhams is going to another member-company of the Hawker Siddeley Group, Armstrong Whitworth Aircraft, Ltd., His work it is stated, will be associated with projects in the armament field.

## The Britannia's Airscrews

FROM de Havilland Propellers, Ltd., comes news that the Proteus 3 turbojets of the 25 Bristol Britannias for B.O.A.C. are to drive D.H. hollow-steel-blade airscrews.

Developed for more than five years specifically to take full advantage of the output of big gas turbines, these airscrews are of the constant-speed, feathering and braking type. In preparation for eventual flight-testing on Proteus turboprops, two of them were fitted last year to Britain's largest piston engines, the 2,450 h.p. Centaurus units of an Airspeed Elizabethan (see photograph in *Flight*, October 26th, 1951).

In airscrews of this size—16ft in diameter—the hollow-steel blade shows a considerable saving in weight in comparison with the solid duralumin blades which D.H. have employed for comparable airscrews during the past 17 years. Although highly advanced, the mechanism is not complicated, and this new model, designated 4/N.6, represents an important step in development.

Credit for the original concept of the hollow-steel blade goes to the American Hamilton Standard concern, with whom de Havilland have worked in close association since 1934; detail design, however, has proceeded independently.

## Wing-spar Life

DURING the past week or two the subject of metal fatigue in relation to airliner wing-spar life has received a good deal of publicity, thereby doubtless causing potential passengers a feeling of uneasiness almost certainly unwarranted by the known facts.

So far, this publicity has been confined to newspaper reports and, at the time of writing, no official statement has been made by the Ministry of Civil Aviation, the A.R.B., or B.E.A. Some unofficial observations have, however, been forthcoming from authoritative sources, and certain precautionary measures announced. The observations confirm that investigation into fatigue, particularly in light-alloy materials developed during and since the war, has been going on at Farnborough and elsewhere since 1948. It is believed that there have been only two examples of wing failure in British civil aircraft—in both cases operating abroad, and in one, unfortunately, with fatal results.

The A.R.B. has now decided to place limits on the life of certain wing-spar components in the case of the Dove and Viking, the reported figures being 4,500 and 10,000 hours respectively.

B.E.A. have stated that they will renew the appropriate components in their Vikings after 8,000 hours, which represents some four years' operation. The failure in one spar of a Viking belonging to Central African Airways was discovered during an inspection, the aircraft having landed safely. B.E.A. are to inspect their spars at approximately 55-hour intervals, although it is not certain that there would always be visual indication of imminent failure. The only recorded Dove failure occurred at 9,000 hours, so the safety margin now proposed appears to be very large.

The requirement will involve operators in additional expense, although there is no suggestion that aircraft should be grounded for immediate replacement of parts. The work will no doubt be carried out when other components of the engine and airframe become due for overhaul or replacement. Incidentally, a somewhat similar requirement—resulting in this case from corrosion—has affected operators of certain aircraft in tropical countries.

We devote a brief leading article to the subject in this issue, while, overleaf, a contributor approaches the phenomenon of fatigue failure from an original angle.

# AIR MINISTER UNDERLINES OUR NEEDS

THE whole question of air defence was given a further hearing on April 3rd, when the House of Lords held a comprehensive debate on the subject.

Great benefit was clearly derived by many speakers from fore-knowledge of the basic facts of the situation so ably expounded by the Under-Secretary for Air, Mr. George Ward, in his estimates speech to the Commons. It reflected much credit, therefore, on the Air Minister, Lord De L'Isle and Dudley, V.C., that his remarks contained hardly a trace of the "tedious repetition" than which there is no greater sin at Westminster.

He began by stressing the importance of air power as the pervasive instrument of war, and the significance of that power in the total military strength of the U.S.S.R. It was now apparent that she had appreciated the value of air power in its own right. She was developing not only atomic weapons, but a powerful long-range bomber force and large numbers of high-performance interceptor fighters. The result was a precarious balance of air power between East and West.

The Air Minister then traced the history of contemporary aircraft development in this country, and emphasised the deep concern which our air defence would give until swept-wing fighters were put into squadron service. A considerable time must still elapse, he said, before British fighters embodying the latest aerodynamic principles were made available to Fighter Command. The Venom, which would come into service this year, chiefly in 2nd T.A.F., did not embody these principles. Two prototypes of this fighter had been ordered in 1948, as an insurance in case a better fighter was needed before swept-wing types could be produced. It was powered by a Ghost engine, with a performance comparable with that of the Nene, of which the Russian designers had made effective use. As the Soviet Air Force had now put a somewhat more powerful version of the Nene in their Mig-15, the plain fact was that there was no fighter aircraft in the R.A.F. today which had as powerful an engine as that which was being utilized by the Russians.

This development high-lighted the problem of closing the performance gap. That could not be achieved without great effort on the part of all in the aircraft industry and in the R.A.F.; and while the Government were confident that the Hunter and Swift would be superior to the Mig-15, they could not be certain that better aircraft than the Mig would not be in sight when our new aircraft came into the squadrons.

Lord De L'Isle and Dudley then described, from a reconstruction of available facts, the rapidity with which the Mig-15 had been put into service. It was probable that the Russians, no doubt assisted by German designers and results of German research, had produced an efficient swept-back wing design before they received the first Nenes from this country. These 25 engines were delivered in 1947, 10 of them in the first half of that year. Within the next few months the Russians must have made up their minds to use this engine in the prototype Mig-15, for it was in July, 1948, that the existence of this prototype became known to us. By that date it was flying. Within little more than a year—by October, 1949—it was known that this aircraft had already reached Russian fighter squadrons. In short, in 2½ years from the receipt of the Nene a high performance fighter, powered by that engine, was being produced in quantity. This same Nene engine, developed to give greater power, had been installed in a twin-engined Russian light bomber which, like the Mig-15, was now being produced in quantity and was in service with Russian squadrons. These facts illustrated how formidable was the technical and industrial challenge which Russia now presented.

The Air Minister then dealt at some length with the question of super-priority, both for aircraft and ancillary equipment. He stressed that quick tangible results must not be expected. The scheme would only have a small effect on all the preliminaries to production—the clearance of designs, preparation of working drawings, and so on. He did not believe that the present deficiencies in the equipment of the R.A.F. could be laid at the door of the existing system of supply. On the other hand, he thought existing contacts between the R.A.F. and the industry must be maintained and, if possible, improved.

Lord De L'Isle and Dudley ended with a reference to the R.A.F. of today, and a firm assurance that pessimism had no place in that young, hopeful, and thrusting Service. The basic organisation of the R.A.F. was sound. It was still improving the quality of its operational technique, and could match in quality and efficiency, if not in numbers, the air forces of Russia and the U.S.A.

LORD BALFOUR OF INCHRYE, who initiated the debate, regretted the slow build-up of modern aircraft for the R.A.F. He doubted if even today a sustained force of 50 obsolete bombers could be raised, far less 50 modern bombers. He was critical, too, of Transport Command, and the statement that in case of emergency the Government could call on civil aviation. In fact, if war came the considerable resources of civil aviation would be engaged on the vital task of keeping open the civil airline communications with the rest of the world.

He considered the question of equipment to be extremely grave. It seemed to him that super-priority did not increase resources immediately. All it meant was a re-deal with the same pack of cards—so that the court cards came out on top. The difficulties were shortages of machine tools, materials, factory capacity, and labour. But each shortage tended to blanket the other, so that all one saw was not an acute shortage in any one direction, but a general slowing down of the programme. Recalling that 23 per cent of the foreign orders of machine tools had been delivered, he said that only 1 per cent of the 10 per cent expected from America had arrived. One aircraft manufacturer was having to use 200 hours of skilled manpower for machining a forging which, with the right tools, he could do in 20 hours with semi-skilled labour. Provision of housing for defence workers was another problem, and he suggested the Government might consider building these houses themselves by contract, own them, and when rearmament was over, sell them to the local authorities or the tenants.

Another suggestion was that the Government should go forward with a policy of temporary caravan camps, a step which Lord Balfour thought would do much to cut down the immediate housing shortage.

He strongly supported the view that one Minister should be responsible for the production of fighting weapons. There might either be a revival of the Ministry of Aircraft Production in a new form, or a special Minister, within the Ministry of Supply and under the departmental Minister, whose task would be to concentrate upon the production of fighting weapons. In any event he had grave doubts whether the present administrative machine was capable of fulfilling the task imposed upon it.

VISCOUNT TRENCHARD put the view that nothing could be more fatal than to base our ideas on the Battle of Britain. There would be no more 1,000-bomber raids; they were dead for ever. The next war would be fought with guided missiles, and with bombers three times as fast and of infinitely greater destructive power. The fighter force could not prevent some getting through, and so it was essential to be able to carry the war to the heart of enemy territory. First priority must be given to long-range bombers and fighters, and in peace the Air Ministry should be responsible for developing machines in direct contact with the aircraft firms. He thought the creation of the Ministry of Defence had lowered the status of the Service Ministers, none of whom were in the Cabinet.

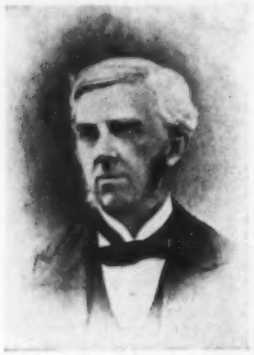
It was wrong to assume that because this organisation went through the last war that we could go through the present peace with the same organisation.

He was sorry that lack of resources would prevent expansion of Transport Command, and urged the Government to take stringent measures to build up a powerful merchant freight air service and to see that up-to-date machines were available.

LORD OGMORE, former Minister of Civil Aviation, suggested the utilization of industrial resources in areas where labour was available. Instead of trying to move labour from Coventry to Hatfield, aircraft manufacture should be taken to Coventry. He did not think the R.A.F. should "crowd out" civil aviation by going into the market and taking all the men and materials to build R.A.F. transport machines. They could use civil machines and should look on civil aviation as a reserve, not as a competitor as was too often the case today.

AIR CHIEF MARSHAL LORD DOWDING said the importance of the swept-back-wing principle should have been recognized by us just as soon as it was recognized by the Russians and the Americans, and to that extent we were to blame.

He thought that as soon as aircraft design was allowed to be concentrated under Government control the result was inefficiency. It was essential that there should be keen competition between designing staffs of the various aircraft firms.



Oliver Wendell Holmes

# FATIGUE FAILURE

## —was Recognised Seventy Years Ago: A Poet's Understanding

By RICHARD HOWARD

**THE news, reported in the previous page, of the obligatory replacement of structural components on certain airliners inevitably recalls Nevil Shute's book "No Highway" and the film based on it. It will be remembered that his plot centred on the possibility of fatigue failure of the tailplane front spar in the Reindeer, a hypothetical airliner. Not until one of these aircraft was over mid-Atlantic was it realized that the life of the component had almost elapsed. The central figure of the story, an R.A.E. scientist who had put forward a nuclear thesis to account for such failures, was on board. Would the tail stay on long enough for the aircraft to reach Gander? This ingenious plot had a sound basis of fact, or at any rate of theory, for its author had had long experience in the aircraft industry. Yet it is a truism that in literature there is no such thing as a new plot . . . and perhaps the following unusual contribution—by an automobile engineer—proves it.**

AT first glance, the proverbial chalk and cheese may appear to have more in common than an eminent American poet and established scientific data. But, strangely enough, Oliver Wendell Holmes, who was a doctor by profession and an author by inclination, also combined these talents with a keen understanding of at least one fundamental engineering problem. Not only did he realize that it existed, but he also grasped its significance long before it received serious consideration by engineering research organizations, of which during his lifetime (1809-1894) there can have existed only a handful.

This problem, the fundamentals of which are discussed below, is dealt with in his delightful and humorous poem *The Deacon's Masterpiece;* and, although it ascends in flights of fantasy, the poem has a basis that is nevertheless theoretically possible and, as the author points out, all strictly logical.

But before his genius in dealing elegantly with the subject can be understood, the principal theme of the poem should be stated. It must also be related to present engineering concepts :—

*Have you heard of the wonderful one-hoss shay,*
*That was built in such a logical way*
*It ran a hundred years to a day,*
*And then, of a sudden, it—ah, but stay*
*I'll tell you what happened without delay,*
*Scaring the parson into fits,*
*Frightening people out of their wits—*
*Have you ever heard of that, I say?*

The failure of engineering components in service was, at the time the poem was written (about 1880), hardly recognized as a research problem and the causes were certainly not often the subject of investigations. As a result of later investigations, however, it is now recognized that metals which are subjected to loads that vary continuously from one value to another, or from one kind to a reverse kind, are liable to failure at much lower values than result from conditions of steady load. This kind of breakdown, as most readers of *Flight* are aware, is called "fatigue failure"; and a fatigue crack in the metal is usually the first signs that failure may ultimately take place.

To Holmes, in considering his projected poem on the performance of the one-hoss shay, no kind of failure other than fatigue failure appeared to be significant. Indeed, the possible alternative kind—that commonly caused by abrasion and wearing out—hardly had a place in his thoughts. Attention was specifically directed to the fact that, in the construction of the vehicle, consideration was to be given to the problem of avoiding failure caused by breaking down rather than to failure caused by wearing out :—

*Now in building of chaises, I tell you what,*
*There is always somewhere a weakest spot,*
*In hub, tire, felloe, in spring or thill,*
*In panel, or crossbar, or floor, or sill,*
*In screw, bolt, thoroughbrace—lurking still,*
*Find it somewhere you must and will,*
*Above or below, or within or without,*
*And that's the reason, beyond a doubt,*
*A chaise* breaks down, *but doesn't* wear out.

The proneness of metals to fatigue failure was first observed some time after Holmes had published his poem, and although the exact nature of this phenomenon is as yet imperfectly understood, a fairly complete picture has been built up in the intervening years of the conditions under which it is likely to take place. This kind of failure can occur, for example, in many engineering components and especially those with which vehicles are equipped. It could certainly have taken place in the one-hoss shay, in the same way as it now does in many mechanical components, among which, for example, may be cited the axles, roller bearings, transmission and crankshaft. Such components are subject to loads which may vary in magnitude many times a minute and it is precisely this type of loading which may lead to fatigue failures at some time during the life of the machine in question.

Although research into fatigue phenomena has to date been mainly restricted to metals, no such limitations were considered by Holmes. His writing implies that for the whole range of materials from which the Deacon's vehicle was to be built, there already existed sufficient data on fatigue characteristics to ensure a long service life :—

*"Fur," said the Deacon, "it's mighty plain*
*Thut the weakes' place mus' stan' the strain." . . .*

*So the Deacon inquired of the village folk*
*Where he could find the strongest oak,*
*That couldn't be split nor bent nor broke . . .*

*Step and prop-iron, bolt and screw,*
*Spring, tire, axle, and linchpin, too,*
*Steel of the finest, bright and blue*
*Thoroughbrace bison-skin, thick and wide;*
*Boot, top, dasher, from tough old hide*
*Found in the pit when the tanner died.*
*That was the way he "put her through"—*
*"There I" said the Deacon, "naow she'll dew."*
*Do! I tell you, I rather guess*
*She was a wonder, and nothing less!*

It is here that we come to the critical point both in the construction of the poem and also in the study of fatigue of metals. As might be inferred, the term "fatigue" conveys the impression of becoming tired, and one of the main factors in the study of fatigue is the observation of the tendency of metals to become tired over long periods of time. This period, known as the fatigue life, is the limiting factor which sets the bounds to the useful life of the component. For example, a broken axle in service is generally one which has reached the end of its fatigue life; its fatigue-resistance has become zero.

It is, of course, evident that a high fatigue-resistance implies a long life and, correspondingly, that a low one implies a short life; but this statement also poses the question of exactly what is involved in the term "long life." Holmes had no hesitancy on this point; for although, according to his poem, the shay was built on Lisbon earthquake day, 1755, the Deacon plainly had in mind an abnormally long fatigue life :—

*But the Deacon swore (as Deacons do,*
*With an "I dew vum," or an "I tell yeou")*
*He would build one shay to beat the taown*
*'n' the keounty 'n' all the kentry raoun';*
*It should be so built that it couldn' break daown.*

In practice, the experimental determination of fatigue life of components involves extensive testing before any idea can be obtained of the probable fatigue-life of metals or component parts. Once this experimental data is obtained, it forms the basis for the scientific prediction of the probable life of similar components and similar materials. As the basis for predetermination of fatigue life, such data is, of course, of considerable practical value to design engineers, who are then able to prepare designs which can be predicted to have a certain specified life. (For example, with roller bearings, and also in the design of gears, there exist whole families of fatigue-life curves which enable intelligent prediction of probable life to be made for these components. Thus, for example, transmissions for combat vehicles can be designed on a short-life basis, whereas transmissions for other vehicles can be designed for longer lives, but certainly not on the basis of 100 years.)

As with much scientific data, there exist some unknown factors which tend to upset the exact fulfilment of the fatigue-life prediction. Although fatigue-life curves exist, there is often also a divergence in actual results from the predicted figures. This may

sometimes be observed in practice in the premature failure of one component; and, although such failures are useful to the engineer in indicating the accuracy of fatigue calculations, they may well constitute nothing less than a disaster to others with less scientific inclinations.

But no such lack of accuracy was envisaged by Holmes. He foresaw clearly a standard of design not even attained to this day, in which all the components had exactly the same fatigue life, and this figure was to be the conveniently round value of a hundred years.

As the fatigue life of a component becomes slowly used up, the designer naturally looks for the first signs of failure. But in this respect at least the one-hoss shay was singularly uncommunicative :—

*Eighteen Hundred—it came and found*
*The Deacon's Masterpiece strong and sound.*
*Eighteen Hundred increased by ten—*
*"Hahnsum kerridge" they called it then.*
*Eighteen Hundred and Twenty came—*
*Running as usual, much the same*
*Thirty and forty at last arrive.*
*And then come fifty and fifty-five . . .*
*First of November—the Earthquake-day—*
*There are traces of age in the one-hoss shay,*
*A general flavor of mild decay,*
*But nothing local, as one may say.*
*There couldn't be—for the Deacon's art*
*Had made it so like in every part*
*That there wasn't a chance for one to start.*

All fatigue failures tend to become a source of danger. Some are not serious in their consequences, whereas others may involve loss of life. Although the actual failure may in itself not be striking, it is almost certain that the immediate results will be spectacular. The direct consequences of fatigue failure of a driving axle of a diesel-electric locomotive at high speed come readily to the mind.

Nor was the consequence of the simultaneous and final failure of the shay less spectacular than would satisfy the best tradition in this sphere, as the next extract shows.

*First of November, 'Fifty-five!*
*This morning the parson takes a drive.*
*Now, small boys, get out of the way!*
*Here comes the wonderful one-hoss shay,*
*Drawn by a rat-tailed, ewe-necked bay.*
*"Huddup!" said the parson—Off went they.*
*The parson was working his Sunday's text,*
*Had got to fifthly, and stopped perplexed*
*At what the—Moses—was coming next.*
*All at once the horse stood still,*
*Close by the meet'n'-house on the hill.*
*First a shiver, and then a thrill,*
*Then something decidedly like a spill—*
*And the parson was sitting upon a rock,*
*At half-past nine by the meet'n'-house clock—*
*Just the hour of the Earthquake shock!*
*What do you think the parson found,*
*When he got up and stared around?*
*The poor old chaise in a heap or mound,*
*As if it had been to the mill and ground!*
*You see, of course, if you're not a dunce,*
*How it went to pieces all at once—*
*All at once, and nothing first—*
*Just as bubbles do when they burst.*

*End of the Wonderful one-hoss shay.*
*Logic is logic. That's all I say.*

The story of the final failure of the one-hoss shay appeared in a number of publications. One which appeared in England in 1891 contains an introduction by Holmes in which he explains the concept on which his poem was constructed :—

> "The *Wonderful One-Hoss Shay* is a perfectly intelligible conception whatever material defects it presents. It is conceivable that a being of an order superior to humanity should so understand the conditions of matter that he could construct a machine which should go to pieces at a given moment of the future. The mind may take a certain pleasure in this picture of the impossible."

The poet's simultaneous failure of all components is still fortunately only a theory—and, even now, not a very attractive one to a design engineer.

## D.H. CANADA OTTER (Continued from page 429)

the stainless-steel firewall. The exhaust is collected in a four-piece manifold and ejected from four short tailpipes. These are surrounded by muffs which, as the only outlet from the cowling, induce the heated cooling air from the cylinders to eject at increased velocity. The system, similar to that on the Convair Liner, reduces power-plant drag to a minimum. The installation was tested for many hours on a full-size mock-up to investigate cooling problems and arrive at the best outlet sizes. There is no gill or other outlet control. The three-bladed airscrew is actually a standard DC-3 type with 3in cropped off each blade. From a distance, when the engine is idling, this large, slow-turning airscrew produces a curious aural effect, for it causes a beating noise not unlike that of a helicopter.

I saw several take-offs at full load: when the engine is opened up and the brakes released the tail comes up, acceleration is rapid and then the Otter lifts off and climbs very steeply. Coming in to land, the approach is made with the nose right down, in an attitude akin to that of a steep dive, but at what looks like a walking pace. Once, when flying alongside in a Chipmunk, I saw that it was impossible to keep down to the Otter's speed when flying level with full flap—about 46 m.p.h. I.A.S.

When flying with George Neal, chief test pilot, I was able to amplify these general impressions. The tests being made when I was aboard were measurements of gliding angle at various speeds with full load. The unfurnished cabin contained ballast, automatic observer, a multiple manometer for flap pressure-plotting and two flight-test observers.

A partly frozen runway, well out of wind, was not the best venue for demonstrating a slow-flying aircraft; but, even so, the Otter nipped very smartly into the air at about 55 m.p.h. I.A.S. Thereafter we climbed (at 75 m.p.h. I.A.S., 2,000 r.p.m., 30in Hg and 750ft/min) at an angle so steep that a head-rest would have been an added comfort! Take-off and initial climb are made with about 30 deg of front flap and about 50 deg on the rear one. When the flaps (operated by a hydraulic hand pump between the seats with a jack in the roof connected by push-pull rod to bell-cranks in the wing) are raised there is a marked nose-up change of trim, but it is quite easily held on the stick until the tailplane incidence has been adjusted by handwheel.

It is scarcely fair to comment on the amenities of an unfurnished prototype, but a few words may be of interest. Cockpit layout is very like that of the Beaver, with a neat T-shaped instrument panel; flight instruments are on the left, engine instruments and controls centrally and radio on the right. The rudder pedals swing instead of being hinged from the floor, but there is the same swing-over stick with a ram's horn wheel. The all-round view is excellent, although rooflights, as on the U.S.A.F. Beaver, would make it even better. The noise level was not high, but the sound had a rather harsh note, which will probably go when soundproofing is complete—although one remembers the hollow bark of the Convair Liner.

We did not cover the full speed range, but I noted that we were making 145 I.A.S. at 6,000ft with 33in Hg and 2,200 r.p.m. The nose was well below the horizon under these conditions and the view was like that from a balcony. Still at 6,000ft, and using a little flap, height could be maintained with only 20in Hg and 1,780 r.p.m. at 50 m.p.h. I.A.S.

Returning to the circuit, the nose-down attitude gave one the curious feeling of being in a balloon. For one thing, the circuit was started at about 1,000ft right over the middle of the aerodrome, from which we made one long, slow, stately descending turn to touch down almost exactly under the spot from which we started. Despite the great change in attitude from the glide to the three-pointer, the round-out was smooth. The landing run was just a short trundle of less than a hundred yards. Bearing in mind the generous size of the fin, the absence of any appreciable weather-cocking tendency was surprising in the strong crosswind that still prevailed.

Altogether an outstanding aircraft; the all-round performance is excellent for 600 h.p. and to be able to carry a ton payload at over 160 m.p.h. *and* at only 50 m.p.h. is good by any standard.

DHC-3 OTTER: PROVISIONAL DATA
(P. and W. Wasp R-1340 Series H (600 h.p. for take-off)

| | |
|---|---|
| Span | 58ft |
| Length | 42ft |
| Height (tail down) | 10ft 6in |
| Wing area | 375 sq ft |
| Wing loading | 18.9 lb/sq ft |
| Span loading | 2.1 lb/sq ft |
| Power loading | 11.9 lb/h.p. |
| Cabin dimensions o.a. | 53.2in/62.5in wide x 58in high x 197in long |
| Max. cabin volume | 260 cu ft |
| Gross weight | 7,200 (7,200 *) lb |
| Basic tare weight (inc. 36lb radio) | 4,165 (4,550) lb |
| Payload, 300 miles | 2,290 (1,890) lb |
| 500 miles | 2,040 (1,640) lb |
| 800 miles | 1,690 (1,265) lb |
| Max. range (190 Imp. gal) | 1,190 (1,000) miles |
| Max. speed (s.l.) | 163 (156) m.p.h. |
| Cruising, 66 per cent M.E.T.O., 5,000ft | 151 (144) m.p.h. |
| 55 per cent M.E.T.O., 5,000ft | 139 (133) m.p.h. |
| Stalling, power off, full flap | 52 (52) m.p.h. |
| Service ceiling | 18,700 (18,000) ft |
| Absolute ceiling | 20,000 (19,300) ft |

*Figures in brackets are estimates for the seaplane version with standard Edo 7170 floats, for a gross weight of 7,540lb. The structure is stressed for 7,500 lb.

# HERE AND THERE

*THE OBLIGING MUSTANG : Removing his suitcase from the gun-bay of his Mustang is Cadet Erik Behrns, one of a party of 20 Royal Swedish Air Force cadets and nine officers who arrived at the R.A.F. College, Cranwell, last week for a six-day stay. In command was Lt.-Col. S. E. Uggla.*

### The Meteor Tug

IN view of the interest occasioned by the reference in these pages last week to a Meteor target tug, we have ascertained from the Gloster Aircraft Co., Ltd., that the modification was a simple one—merely the fitting of a bomb slip under the fuselage, with a cable-release in the cockpit.

### A French Blow-out

A GLOSTER METEOR has recently been modified in France for use as the test-bed for the S.N.C.A.S.O. ejection seat. The first ejection was made on March 12th, when Andre Allemand was shot out from 5,000ft at 310 m.p.h. Further tests will be made at greater speeds and heights. The aircraft is a Mk 7.

### Smart Work

CAPT. WILLIAM B. SMART, the pilot of a U.S. Marine Corps fighter-bomber—probably a Corsair—in Korea, was engaged on cutting communist railway-lines. With his aircraft hit by anti-aircraft fire he baled out, only to be captured by enemy troops. An air-rescue squadron was called up and Smart's captors were subjected to numerous strafing attacks; they quickly ran for cover and Capt. Smart was hauled into a helicopter and brought home unscathed.

### London-Birmingham B.I.F. Service

A DAILY Dove flight between London and Birmingham will be operated from May 5th-16th—the period of the British Industries Fair—by Olley Air Services, Ltd. Fare for the return trip will be £5 18s. Take-off will be from Croydon at 0945 hr each weekday, and the time of arrival at Castle Bromwich—where the engineering section of the B.I.F. is held—is 1045 hr. Departure from Castle Bromwich will be between 1700-1800 hr. Bus and rail services will link Croydon with the B.I.F. sections at Earl's Court and Olympia.

### Room for Expansion

SOME 75,000 sq ft of extra floor space, to be used for storage in connection with Sea Hawk and Hunter production, has been acquired by Hawker Aircraft, Ltd., as a result of their obtaining a short lease of the Teddington film studios, not far from their Kingston-on-Thames factories.

### Canberra Record Confirmed

THE Canberra flight by S/L. L. de Vigne on February 18th, from London to Castel Benito, has been confirmed as a point-to-point record by the F.A.I. The bomber covered the distance of 1,469 miles in 2 hr 41 min 49.5 sec, an average of 538.12 m.p.h.

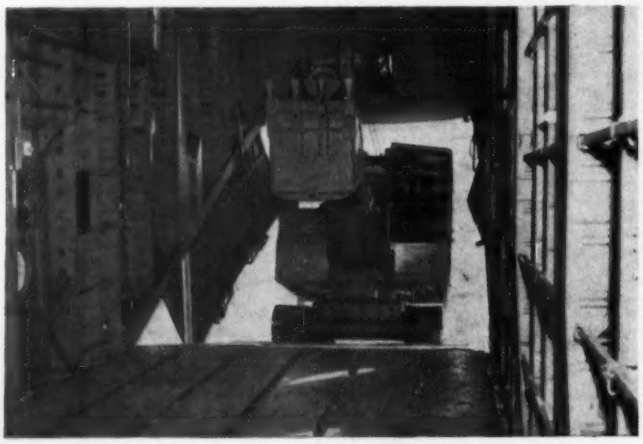
### The Easter Record Attempt

TO amplify the information contained in our brief announcement last week, it is now possible to add that preparations for the light-aircraft speed record attempts projected by T. W. Hayhow for the Easter week-end are progressing smoothly. The records aimed at are in class C.1b, for aircraft of between 500 and 1,000 kg (1,102 and 2,205 lb) all-up weight; Mr. Hayhow's flights will be observed by the Royal Aero Club in order to qualify as F.A.I. records for Great Britain. It is the intention that the single-seat Aiglet Trainer to be used (G-AMOS) shall make record flights from Elstree airfield to Paris, Brussels, Luxembourg, Dublin and Amsterdam. Air-racing enthusiasts will recall that the Aiglet G-AMIH (normally to be seen at Fair Oaks) in which Mr. Hayhow competed last season was exceptionally fast : finishing second in the *Daily Express* Race, it averaged 135 m.p.h.

### Canadian Missile

THAT Canada is making a new air-to-air guided missile was announced last week by Dr. O. M. Solandt, chairman of the Canadian Defence Research Board. He said that the weapon was being developed by the Armament Research and Development Centre at Valcartier, near Quebec, for the R.C.A.F. (This news serves to the strengthen speculation—reported elsewhere in this issue—about the future armament of the CF-100.) The doctor also spoke of the need for standardizing weapons; Canada, in this respect, is in an unfortunate position, her equipment being half English and half American.

*A TEN-TON EXCAVATOR was recently employed in trials to gain experience with the loading of heavy tracked vehicles into the Blackburn and General Aircraft Universal Freighter. Tests with big pneumatic-tyred vehicles—including a 30-seater coach—were also made.*



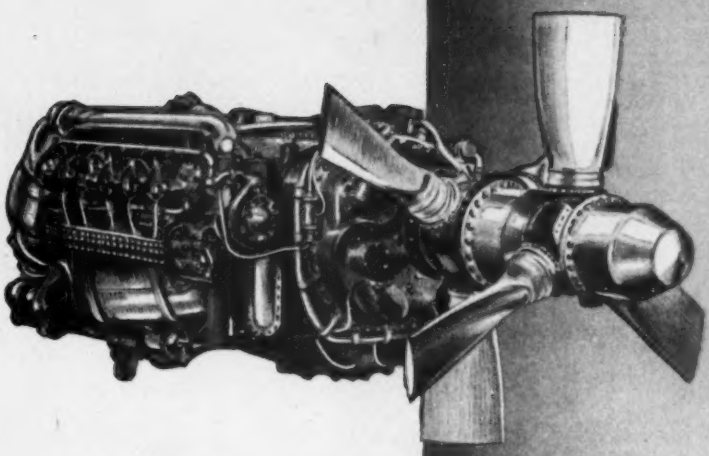
### Russian Air Force News

RUSSIAN air activity over Germany is intensifying after some slackening. A fortnight ago groups of Mig-15s and jet bombers were observed over Berlin; some of the Migs are reported to have wings of slightly longer span with rounded tips. Another report mentions a new twin-jet machine with the power units under the wing, close to the fuselage. Wing and tail surfaces are straight. In Hungary, large powered gliders have been observed.

### Historic Films at R.Ae.C.

THE last of this season's film shows for Royal Aero Club members and their guests will be given at Londonderry House at 6.15 p.m. next Tuesday, April 15th. Capt. Kimbrough S. Brown, U.S.A.F., representing the U.S. National Air Museum, will show, and give a commentary on, four notable films : One of them is of the 1914-18 war period, and includes shots of von Richthofen and other German "aces"; another deals with long-range reconnaissance aircraft in the 1939-45 war; and the third is about parachuting in the

# NAPIER



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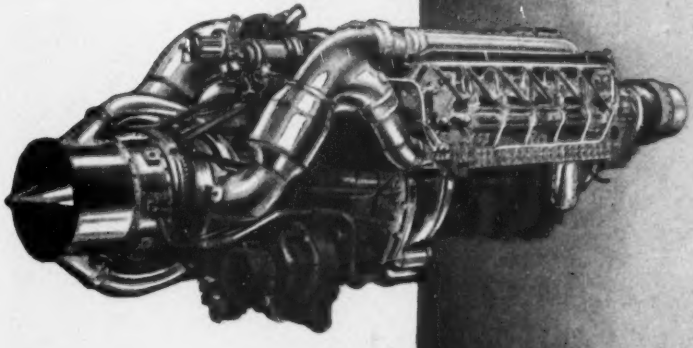

# NOMAD

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## HERE AND THERE . . . .

same struggle. Capt. Brown will also show *Air Force Fighter Kills*, a U.S.A.F. film of the 1939-45 war. The programme will conclude with the colour documentary *Memphis Belle*, illustrating the history of a B-17 from production to war service.

### Short Circuits

WITH the not-very-explicit name of "nacelle-tester", a new device developed by the Bogue Electric Manufacturing Co., of New Jersey, is said to be capable of checking 200 aircraft electric circuits in, it is claimed, less than ten seconds. Hand-testing the same circuits would take several hours.

### The Grosser Knechtsand

THE West German Government has proposed to the British Government that the R.A.F. should limit to two years its use of the Grosser Knechtsand—a sandbank near Cuxhaven—as a bombing target. Professor Walter Hallstein, head of the West German Foreign Ministry, has said that this was one of several proposals made during negotiations concerning the use of the sandbank as a substitute for Heligoland, restored to Germany on March 1st. The Professor added that the use of the sandbank could be extended for a further two years if necessary.

### Automatic Astro-Navigator

A RETIRED captain of the U.S. Navy, Robert E. Jasperson, has developed a "distance-measuring" navigational device based upon the Zerbee Celestial Fix-finder. This latter invention was patented in 1950 and uses declination, G.H.A. and altitude of two selected celestial bodies to give the observer's latitude and longitude automatically. With Capt. Jasperson's modifications, the latitude and longitude of the observer's destination is supplied to the apparatus and an immediate course-to-steer and distance-to-run are presented. The captain is also the inventor of an astro-controlled autopilot for guided missiles; once this device has been set upon two stars it is claimed to continue to function even if one, or both, of them is temporarily obscured.

*WYVERN'S "OPPO.": A new view of the Douglas A2D Skyshark, American counterpart of the Westland Wyvern carrier-borne strike aircraft. The power plant is an Allison T-40 turboprop, composed of two separate T-38 units.*

### Helicopter Profit

"A MODEST net profit" of a little over $120,000 (£42,860) is shown in the recently issued annual report of Hiller Helicopters. The company believes that it ranks among the top producers of helicopters so far as 1951 deliveries were concerned; security restrictions forbid disclosure of output, but sales rose from $¾ million in 1949 to $1¼ million in 1950 and over $6¼ million in 1951.

### Air-minded Royal Family

ON April 1st, H.R.H. Queen Juliana and Prince Bernhard left Schiphol Airport, Amsterdam, on a three weeks' tour of the United States and Canada. They travelled in the K.L.M. DC-6 *Princess Beatrix* PH-TPT. Before she left, Her Majesty expressed herself as being very happy about the journey. Prince Bernhard—who regularly pilots the Royal Dakota—said that, although many in the Netherlands were worried that the Royal couple should travel by air so frequently, he considered air travel "as safe as travel by car, and sometimes even more so."

*PROGRESS CHASER: Equipped with Marconi walkie-talkie and mounted on a Corgi with sidecar, this B.E.A. tarmac observer has a wide variety of duties concerned with the expeditious handling of aircraft on the ground. He is seen alongside the Elizabethan R.M.A. "William Shakespeare," new in scheduled service.*

## IN BRIEF

INDOOR recreational facilities for the 2,700 employees of the Plessey Company's Swindon works are provided by a new social club which was opened on March 14th by Mr. T. White Wilson, executive director.

* * *

McMichael Radio, Ltd., have appointed Genaire, Ltd., Municipal Airport, St. Catherines, Ontario, as their agents in Canada for electronic and electrical equipment applicable to the aircraft industry.

* * *

Organized by Aircraft Trade Shows, Inc., an international exhibition of aircraft components and equipment is to be held at the Hotel Park Sheraton, New York, from June 17th to 19th.

* * *

The American Library, 41 Grosvenor Square, London, W.1 (Grosvenor 9000, extn. 447 or 448)—a U.S. Embassy department—has established an industrial technical publications (loan and reference) section.

* * *

Referring to a recent note on the appointment of W/C. C. E. Payne as their Australian agent, W. A. Rollason, Ltd., of Croydon Airport, ask us to say that the announcement which they issued should have referred to "W. A. Rollason, Ltd., and Rollason Engines, Ltd." as the companies concerned.

* * *

A new edition of *Aircraft Gyroscopic Flight Instruments* has been published by the Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. This edition, the fifth since 1946, contains a new chapter on the Zero Reader and also introduces a comprehensive explanation of gyro-horizon turn errors. The book, rearranged to be completely up-to-date, is more than twice as long as the original edition. The price is 3s 6d.

* * *

The Society of Licensed Aircraft Engineers announces that, in connection with the Notification of Vacancies Order, 1952, the Society's employment bureau (which is licensed annually by the Corporation of the City of London) has been accepted as a scheduled employment agency by the Ministry of Labour and National Service. The S.L.A.E. offices are at Finsbury Circus House, Blomfield Street, London, E.C.2.

# TURBOJET-TRANSPORT PERFORMANCE

## *New Cruise-control Techniques Assessed in an R.Ae.S. Section Lecture*

A SECTION LECTURE of the Royal Aeronautical Society, entitled *Some Aspects of Civil Jet Aircraft Performance*, was read on March 27th by Mr. D. R. Newman, A.F.R.Ae.S., a senior aerodynamicist of the de Havilland Aircraft Co., Ltd. His remarks—a digest of which follows—were not confined to the operation of the Comet, but embraced various interesting aspects of performance estimation, measurement and analysis. He did not attempt to deal exhaustively with any one particular branch of the subject.

The cruise-control technique was [said the lecturer] perhaps one case where the operation of a long-range turbojet aircraft differed most markedly from that of a piston-engined aircraft. With the latter type the practice had been to cruise at constant altitude and, where long ranges were involved, to reduce power and speed as fuel was consumed, in order to maintain the cruising threshold speed appropriate to the weight. This procedure would not give the optimum range with a turbojet aircraft.

It was helpful to think of the miles-flown/fuel burnt of a jet aircraft as being proportional to $\frac{L/D \times V}{W \times lb/lb/hr.}$ The specific fuel consumption expressed in lb/lb/hr did not vary greatly with speed at given r.p.m.; generally speaking, therefore, maximum range was obtained when the product of L/D and V was a maximum. Conversely, the maximum range with a piston-engined aircraft was obtained at the best L/D ratio or as near to it as it was practicable to operate.

Making certain simplifying assumptions, it could be shown that, for a turbojet aircraft at constant altitude and variable r.p.m., the product $L/D \times V$ reached a maximum at $\sqrt[4]{3}$ times the minimum drag speed Vmd. Similarly, at constant r.p.m. and variable altitude the function had a greatest value at $\sqrt[4]{2}$ Vmd in the stratosphere, or at a slightly lower speed in the presence of a lapse rate. Fig. 1 presented a comparison of cruising speed and miles flown per pound of fuel over a representative weight-range for three possible cruising techniques.

Mr. Newman pointed out that the important factor visible in the curves was not so much the range corresponding to a given aircraft weight as the end-of-flight weight for a given range, which determined the payload on critical route stages. The optimum range technique—ideally the maintenance of a constant angle of attack, although commonly spoken of as "constant incidence"—consisted in practice of providing the pilot with an appropriate curve of I.A.S. plotted against aircraft weight and requiring him to maintain the desired I.A.S. Altitude would then progressively rise as fuel was consumed and would also vary with the ambient atmospheric temperature. Compressibility effects [which the lecturer had ignored up to this point] might result in the cruising speed being reduced below the ideal optimum.

This "constant incidence" technique resulted in a cruising Mach number which increased as ambient temperature fell (AB in Fig. 2). At low temperatures the Mach number achieved might be such that compressibility drag rise began to be felt; this effect might be avoided by adopting a constant Mach number technique (line CD). But this chosen Mach number might be unattainable at cruising r.p.m. if temperature rose sufficiently, while a smaller rise in temperature could be sufficient to impose operation at a lower altitude with consequent bad effects on economy.

One possible solution might be to instruct the pilot to fly at constant incidence above a specified ambient air temperature and at a specified Mach number if temperature fell below that value (line AC in Fig. 2).

Yet a further solution might be to provide each power plant with a governor to maintain a constant value for r.p.m. divided by the square root of ambient temperature; this would merge the constant incidence and constant Mach number techniques into one.

Mr. Newman then discussed the question of speed stability. The practicability of the described cruising techniques might be doubted in view of the differences between the thrust/power curves for piston and turbojet aircraft. With the adopted turbojet techniques no attempt was made to maintain both speed and altitude simultaneously; disturbances from the stabilized condition were translated into altitude variations, the reserve thrust available at an altitude below the datum value being used to restore the aircraft to the stabilized condition at the specified speed or Mach number.

The lecturer then dealt at length with the effects of changing air temperature. This was the most important single factor determining the performance of a turbojet aircraft; it was difficult to forecast before flight, being widely variable from day to day and from place to place. A rise in temperature of 1 per cent caused a loss in speed of about 0.5 per cent in a constant $C_L$ cruise at 1.2 Vmd, or about 1 to 1.5 per cent in a constant altitude cruise at 1.3 Vmd.

A similar 1 per cent temperature-rise reduced the miles/lb value by a little over 0.5 per cent in the former technique and yet caused a 1 per cent increase if the aircraft was being flown according to the latter—provided drag was not greatly affected by Mach number changes.

The constant-incidence cruise technique was, therefore, less sensitive to temperature variation than was the constant altitude method; this advantage was underlined by the fact that a rise in temperature of only 4 per cent (about 9 deg C) could bring the absolute ceiling at cruising r.p.m. below the planned cruising height at 1.3 Vmd.

Summarized, the lecturer's conclusions regarding cruise-control were that for all but short-range operations a variable-altitude cruising technique was required; basically this should be constant-incidence flight, but for higher-powered aircraft it might be necessary to employ constant Mach number cruising, at least at low ambient temperatures.

Mr. Newman foresaw air-traffic control problems when altitudes above 35,000ft became more congested than at present; these problems would be accentuated by the adoption of the constant-incidence technique and by the difficulty of forecasting a suitable height at which to fly on the constant-altitude technique. It appeared that vertical separation would no longer be practicable, while the possibility of aircraft flying on reciprocal courses with closing speeds of up to 17 miles per minute suggested the need for some form of control or collision warning.

The lecturer observed that the turbojet was much more sensitive to r.p.m. changes than was the piston engine, and demanded much greater accuracy of engine handling, especially at the top end of the output range. The jet-propelled aircraft was also sensitive to

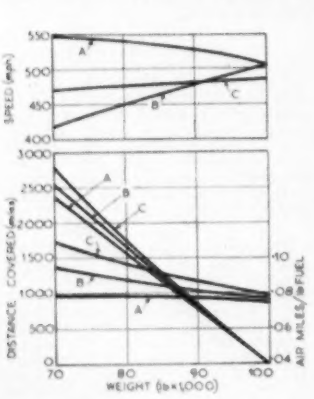


*Fig. 1 (left). A comparison of cruising techniques. Curves A refer to the constant r.p.m. and constant altitude technique; Curves B to constant altitude at 1.3 Vmd.; and Curves C to constant r.p.m. at 1.2 Vmd.*

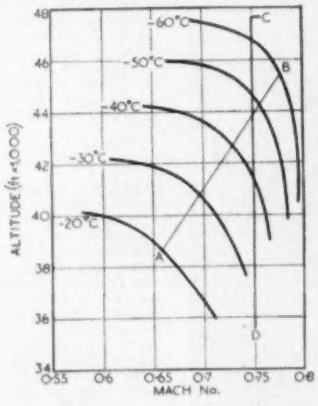


*Fig. 2 (right). Comparison of Mach number with altitude and atmospheric temperature, together with suggested cruising techniques.*

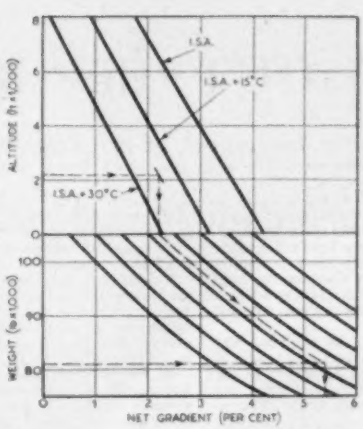


*Fig. 3 (left). Presentation of climb gradient in the form generally accepted as standard at the present time.*

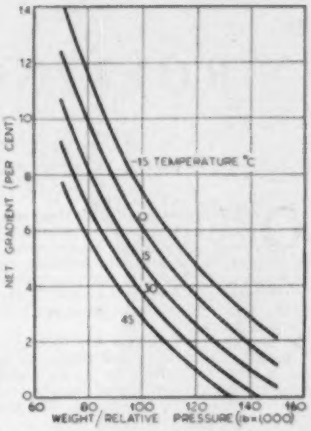


*Fig. 4 (right). Presentation of climb gradient in terms of W/p as advocated in the accompanying lecture.*

weight changes; an initial error of 1 per cent in weight could lead to errors of 1 per cent in speed and about one-half per cent in miles/lb fuel in a constant-incidence cruise.

Present experience indicated that measurements of fuel contents could not be made with a sufficient accuracy for turbojet aircraft, while such measurement, and that of fuel flow, was complicated by the wide variation of temperature which might be encountered, namely, from 40 deg C down to −35 deg C.

The need for the long-range turbojet aircraft to cruise near to its ceiling was largely responsible for a general sensitivity to atmospheric changes. At the optimum 1.2 $\sqrt{\sigma}$d cruise condition variations of $\pm 1$ per cent could be caused by up- and down-currents of as little as ½ ft/sec. The fact that cruise control was based upon local atmospheric temperature and pressure could also cause variations in cruising speed; surfaces of constant atmospheric pressure were rarely tangential to the earth's surface, but sloped upwards away from atmospheric depressions. The 300 mb surface had, on one occasion, been found to increase in altitude by as much as 1,800ft in 475 miles, representing a gradient of 0.072 per cent; this could affect the speed of an aircraft flying at constant-pressure altitude by up to 6 m.p.h.

The lecturer spoke of the increasingly wide range of conditions over which performance data were required and, because of the rather more limited spread of possible test-measurements, a new approach to the subject of performance reduction became necessary.

Further to this argument he suggested that standard differential reduction methods might have to be, and in many cases had been, abandoned; in their place a system of performance analysis would be used to synthesize the information required over the necessary range of conditions. This analysis would take various forms according to the type of problem faced. In particular, the possibility of presenting turbojet performance in the so-called "non-dimensional" form would greatly aid such analysis, since it enabled variation of power output with altitude to be predicted much more readily than had been the case with the piston engine.

It was Mr. Newman's personal opinion that complete tropical trials would not be necessary with turbojet aircraft; rather, they would merely take the form of a confirmation of the predicted temperature/performance figures, as had been found with the Comet.

Elaborating upon the consequences of engine non-dimensional behaviour, the lecturer showed that, for a given cruising technique at a fixed $C_L$, the relation W/p (aircraft weight divided by atmospheric pressure) was a function of $N/\sqrt{T}$ (r.p.m. divided by square root of atmospheric temperature). In performance testing of such a technique, the altitude was the primary unknown to be established; a series of stabilized conditions at various values of r.p.m. would, therefore, be determined and the resulting values of W/p plotted against $N/\sqrt{T}$.

Flight at constant $C_L$ also implied that the values of true speed and miles/lb × W were functions of ambient temperature only. This "non-dimensional" approach allowed Reynolds number effects on engine performance to be neglected at the altitudes foreseen, while the effect on aircraft drag needed only to be considered over the range of Reynolds numbers applicable to cruising flight, and over this range the drag variation was not great.

The performance items required for certification purposes were also amenable to such treatment. Cases arose of a climb gradient being required at a given $C_L$ and r.p.m.; under these conditions it could be shown that the gradient was a function of W/p and T only. Similarly, ground distance covered in acceleration to an unstick speed defined by a constant $C_L$ could be expressed as: Distance (constant r.p.m.) = f(W/p, T).

The use of such relationships had led to considerable reduction in the time required to calculate take-off performance and to correlate observed performance under different conditions.

The method accepted as standard in the presentation of flight manual data was illustrated in Fig. 3. Basically, the performance was plotted for a datum weight and a grid then employed to facilitate the correction to other weights. The use of W/p as a parameter (Fig. 4) removed the need for this grid and reduced the inevitable slight inaccuracy in presentation and reading which it involved. A single curve of W/p against weight and altitude served to assist in the use of all take-off and climb charts drawn up in terms of W/p.

The lecturer commended the use of such a method of presentation—which was used in the flight manual for the Comet—before custom became too deeply rooted in the use of the standard form.

## THE AESTHETIC VIEWPOINT

A RECENT paper, *Design in Transport*, by George Williams, Industrial Officer (Transport) of the Council of Industrial Design, dealt with a sometimes-neglected subject in a most comprehensive manner.

Mr. Williams devoted the major part of his lecture—which was read before the Institute of Transport in London on March 24th—to a discussion of railways and automobiles, in which the taste of the public could have a profound effect upon the original conception of the engineer. The resulting products were consequently subjected to both praise and criticism by Mr. Williams, who suggested numerous improvements.

Readers of *Flight*, however, will be gratified to learn that aircraft, as a generic family, were let off very lightly. The Valiant, for example, was described by the lecturer as the work of a designer who would stand no nonsense, whose aim was to produce a form which would achieve the highest possible performance under given conditions, irrespective of false "style," fashion or sales appeal.

The designer and operator of civil aircraft, working under strict weight and space limitations, maintained a continuous search for suitable upholstery materials and accessories and paid careful attention to colour schemes. B.O.A.C., for example, had compiled schedules of suitable wall coverings, carpets, seat upholstery and colours to ensure standardization throughout their fleet of airliners and coaches. The interior decoration was designed to induce a feeling of comfort and spaciousness in all climatic conditions, both by day and when, by night, only the aisle lights and an occasional reading light broke the darkness. The effect of lighting, particularly fluorescent, had also to be considered.

## NICKEL-COATED ALUMINIUM

DURING the past two years the Hamilton Standard division of United Aircraft has co-operated with Bart Laboratories, Inc., to develop a process for the nickel-coating of aluminium. A synthetic rubber compound is first sprayed on to the metal to the required thickness. When this is dry, the nickel is deposited by "conventional means"—the nature of which is unstated—to the desired depth of coating; the whole process takes about 24 hours.

The resulting nickel layer gives a Vickers-hardness number of 400 to 450 and is claimed to be stress-free and very strongly bonded over a wide temperature range. Satisfactory results are stated to have been obtained with all aluminium alloys so far used, while the deposition is uniform over intricate designs on interior, or exterior, surfaces.

The process is of major importance in the protection of duralumin airscrew blades in naval service; airscrews so treated are already in service on the Martin P5M Marlin and Grumman UF Albatross flying-boats.

# ROLLING-OUT the BARREL

## *A Swedish Pilot's Impressions of the Rotund Saab J-29*

ONE of the first Swedish Air Force officers to fly the 650-m.p.h. Saab J-29 was Lt. Percy Silfvenberg, who has since contributed to the makers' house-journal some brief impressions of its characteristics. As the following extracts show, it appears that the J-29's designers have succeeded in marrying the high performance available from a 5,000 lb-thrust de Havilland Ghost turbojet with the moderate low-speed handling qualities required for military usage.

"The cockpit," reports Lt. Silfvenberg, "is equipped and arranged in a most practical manner, so that one feels rapidly at home in it." Although the 30-deg backward inclination of the ejector seat felt unfamiliar at first, he found it comfortable, and the field of vision was excellent. The steerable nosewheel, controlled by a short lever in the cockpit, also gave an unusual first impression (although the steering technique was quickly mastered), since the aircraft rolled on its narrow-track undercarriage during sharp taxying turns.

For take-off, the Ghost gave rapid acceleration—". . . I held the stick neutral and the aircraft practically flew itself off when the speed reached 112 m.p.h. With undercarriage and flaps up, the speed rose very quickly and the climbing speed was as high as that a J-28 (Vampire) pilot is used to reading for cruising speed in level flight."

In flight, Lt. Silfvenberg found the J-29 to give a normal response to the pilot's control movements. The hydraulically powered ailerons felt very light, but elevator control was rather heavy and the aircraft was stable in the looping plane. Tail trimming was effected by the variable-incidence tailplane (itself electrically actuated by a switch on the control column); the aircraft responded very quickly to changes in trim, so that "a little care is needed on the part of the pilot, particularly at high speeds."

Ailerons were less effective at low speed, particularly during the final approach; large aileron-movements were necessary for small changes in direction or to counteract gusts. The pilot's first impression of this characteristic was unfavourable, but he stressed the need to avoid violent changes of direction at low speed with full flap—with this and most other modern high-speed aircraft.

The landing "was not difficult, but because of the aircraft's low-speed characteristics it demanded plenty of concentration to avoid losing too much speed. At the stall, which occurs at a surprisingly low speed because of the effect of the slots . . . there is a marked raising of the nose . . . aerodynamic drag causes speed to drop rapidly if the aircraft is balanced on the main undercarriage with the nose so high that it is almost on the point of overbalancing on to the tail."

Summing up, the Swedish pilot describes the J-29 as "an exceptional fighter with the capacity to strike hard and quickly, and with the qualities to win the pilot's complete confidence."

*A lively impression of the Ghost-powered Saab J-29, the only Western European swept-wing fighter in service*

## SHAKING THEM UP

AN unusual structures rig has recently been introduced by the Bell Aircraft Corporation in order that studies may be made of the effects of large-amplitude vibrations on aircraft and guided-missile components. The rig takes the form of a 40-ft tower, within which a mounting chamber is suspended by multiple shock-cords. These in turn are anchored to nitrogen-driven pistons at the base and head of the tower.

The tower is said to be capable of accommodating components weighing up to 3,000 lb, and to be able to "shake" them at frequencies up to 15 c.p.s. over amplitudes up to 5ft. The vibration is forced by the head and base pistons which can be regulated through a timing device actuating cycling valves to vary piston-frequency and stroke either in phase or in any ratio out of phase.

Large-amplitude vibrations are perhaps more usually produced by electrically driven vibrators; on page 454 of this issue is illustrated a British low-frequency generator-set designed to supply current for such equipment.

*The new Bell vibration tower (see above) for subjecting components to low-frequency large-amplitude vibrations. Power is from nitrogen, compressed in the cylinders seen on the truck.*

## ANOTHER R.C.A.F. AIRFIELD

THE war-time airfield at Langar—about ten miles E.S.E. of Nottingham—is to be occupied by the Royal Canadian Air Force. Since the war it has been used as a maintenance base by A. V. Roe and Co., Ltd., who will continue to have the use of it.

Many of the R.C.A.F. personnel will be housed in Nottingham, but Bingham Rural Council, which has tenants in huts round the airfield, has been warned that some of them must leave.

## CANADIAN FIGHTER PROGRESS

SPEAKING in Toronto last week, Mr. Crawford Gordon, Jr., president of Avro Canada, said that production of the Canuck two-seat all-weather fighter would reach a high rate next year but had been retarded by "large-scale changes in the armament requirements." Since the original armament is reported to have included four 30 mm cannon, there seems every justification for assuming that the revised armament will be based principally upon guided missiles. This assumption is underlined both by recent reports of Canadian missile development and by the fact that Mr. Gordon referred to the Canuck specifically as a bomber-destroyer.

In the same address, Avro Canada's president announced that all Canadair-built Sabres would be of the F-86E type powered with the Avro Canada Orenda turbojet. Choice of this new power plant should provide a still higher performance for the Sabre; Mr. T. K. Finletter, U.S. Secretary of the Air Force, recently stated that Canadair had agreed to supply "a large number" of Sabres to the U.S.A.F. in addition to those now being built for the R.A.F. and R.C.A.F., all with the Orenda in place of the original J-47.

In passing, it may be mentioned that a much-modified Sabre, armed with 20 mm cannon, is to be produced in Australia; this version will be powered with the Australian-built R-R. Avon.

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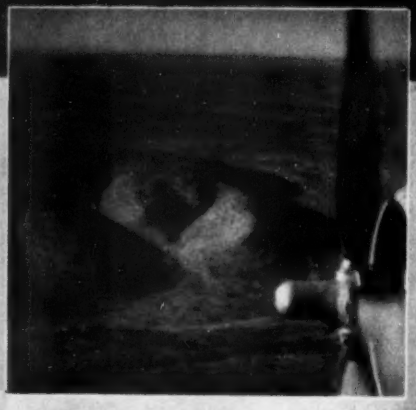

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# No. 201 SQUADRON R.A.F.

*The History of a famous Naval and Coastal Command Unit: Part One, 1914—1919.*

By JOHN YOXALL

THE unit which forms the subject of this history had its origin in No. 1 Squadron R.F.C. (Naval Wing), which was raised on October 16th, 1914, at Fort Grange, Gosport, under the command of Sqn. Cdr. A. M. Longmore, who had been specially recalled from Ostend for the express purpose of forming it. Until then, the pilots and aircraft of the Royal Flying Corps (Naval Wing) had not been formed into squadrons. The title, R.F.C. (Naval Wing), had fallen into disuse and "Royal Naval Air Service" substituted. In his book *From Sea to Sky* Air Chief Marshal Sir Arthur Longmore recalls those days and tells how naval technicians visited all the bicycle shops and garages in Portsmouth to sign on mechanics for ground crews.

Major S. V. Sippé, a pre-1914 demonstration pilot, a flight lieutenant in the original Eastchurch squadron, and a member of No. 1, has also recalled for us some memories of that time:—

"The miscellaneous collection of aircraft taken over originally by No. 1 Wing," he writes, "were soon augmented by the purchase of French Nieuports, Morane Parasols and a few Caudron biplanes. Some Henry Farmans were also purchased, but the main production of these did not arrive till some time later.

"Captain Elder, accompanied by Spenser Grey and others, visited America to see what could be obtained from that source. The best available from a poor bunch was the Curtiss, and a few (fortunately) arrived in due course. They were inferior in performance and construction to the contemporary English and French types and the engine was extremely unreliable. They were soon withdrawn.

"Flying instruments in 1914 were elementary and simply consisted of A.S.I., revolution counter, clock (if it had not been stolen) and compass. This latter was of little practical value owing to its habit of spinning on the slightest provocation.

"Armament was what could be improvised. Lee-Enfield rifles (fixed to the struts) and pistols were the earliest ideas. Then came a few Lewis guns, which were carefully hoarded by the armament officer and only loaned out with extreme reluctance.

"Bombs were carried in simple racks developed as a result of the Friedrichshafen raid; any 'extra' types, such as petrol bombs or rifle grenades, were carried by the pilot or rested in the fuselage, ready to be thrown out. The French *fléchette*, a steel dart about 6in long and carried in boxes, was available, and I think a few were dropped on transport in the very early days. The next type of bomb, of about 65 lb, was carried by the Farman and Caudron types and was successfully used in anti-submarine work and Zepp-shed bombing.

"Ordinary clothing was used, augmented perhaps by a highly coloured scarf and the best goggles and gloves one could afford—there was no Service issue. Most of the pilots sported a Gieves Floating Waistcoat, the prototype of the Mae West.

"Oxygen supply had not been thought of and, though some pilots got up as far as 16,000ft and even 20,000ft, the need was not felt. Perhaps ignorance was bliss. In any case, the ceiling of the Nieuports and Moranes was about 12,000ft, and this was ample for operations other than Zeppelin patrols. Bombing was carried out at any height from 2,000ft to 6,000ft and this latter height was pretty safe, as invariably the 'Archie' (A.A.) was above you. Only direct hits and falling fragments were dangerous. Anti-aircraft fire was pretty fierce along the Belgian coast and for some way inland. It was said that this was the German A.A training ground, and I can quite believe it from the intensity of the bombardment which was put up at the slightest provocation.

*A line-up of R.N.A.S. Type C Bristol Scouts at Dunkirk early in 1915. The Union Jack painted on the fuselage was chiefly intended as a protection against wrong identification by our own ground forces.*

# No. 201 SQUADRON R.A.F. . . .

"The raids on Ostend and Zeebrugge of February, 1915, mentioned in Sir Arthur Longmore's book, were an example. On the second day, which was bright and cloudless, the sky was just covered by bursts—I have never seen since such a complete coverage; and, strangely enough, the bursts were well above the highest machine, which was probably at 5,000ft, although there was a lot of lower stuff of various kinds.

"During 1915 and 1916 the great minefield operation was carried out and we were flying protection patrols. The sight was magnificent, and even at a few thousand feet the stream of craft extended to the horizon in both directions.

"Observing for, and protecting, the monitors was quite a game. The monitors' maximum speed was about 5 knots and they were very fussy as to weather—it was always too clear, too thick or too something—and we were alerted and "rendezvoused" many times without a bombardment taking place. The lighthouse at Ostend was the only thing which stuck up on the Belgian coast and was, therefore, an important navigational aid for the fleet. We pilots were warned under pain of death to keep clear. To our delight, one of the early shoots with 12in guns knocked it for six. We wrote poems about it."

Recalling the power plants of the early war years, Major Sippé goes on: "Nearly all our machines used the Gnôme or Le Rhône rotary engine. (Exceptions were the Canton Unnés, Renault, Anzani, etc., fitted in Farman, Caudron and other types.)

"The Gnôme, particularly, was a beautiful job and certainly enabled aviation generally to forge quickly ahead. It was extremely easy to fit in a fuselage, and was light and vibrationless. The main snag was in the piston-head inlet valve: when the little springs retaining this valve broke, the mixture in the crankcase caught fire, power fell to almost nothing, and a series of fiery coughs were emitted through the crankshaft air-intake, straight on to the pilot's, or observer's, chest. A heavily bearded French mechanic of mine caught fire on one occasion and there was quite a flap before he could be quenched.

"The Le Rhône was fitted with mechanically operated valves and to a certain extent could be throttled down. It was not as sweet-running as the Gnôme. Generally speaking, these engines were surprisingly reliable, but subconsciously one always had one eye searching for a suitable landing-place. Quite a lot of night flying was carried out while searching for Zepps. I did a lot over Holland, Belgium, and Northern France; others did much while bombing hangars at Brussels and targets at Ostend and Zeebrugge.

"Illumination of the cockpit or map was by electric torch carried in the pocket, and take-off was by the light of paraffin flares. Landing was usually by chance—or left until first light. Navigation was not too difficult, for the canals of Belgium, the sea and the battle-line gave a good sense of direction even in bad weather. In any case, a lot could be seen at night, and I never had any difficulty in finding my way during months of 'every-night' work."

On October 20th the squadron was allotted four 80 h.p. Gnôme-engined Bristol biplanes—which the R.F.C. did not want—and by November 14th had seven pilots on strength, including the C.O. The first officers to be posted to the unit were Flt. Cdr. A. W. Bigsworth and F/L. G. M. Dyott.

The first operational flying came on November 23rd, when the four Bristols started coastal patrols in the Newcastle-upon-Tyne area, watching for hostile warships. The Bristols had flown from Gosport to Farnborough, but, owing to bad weather, they had gone on from there to Newcastle by train.

At the beginning of December, Longmore returned to Gosport, leaving at Newcastle a flight of two Bristols under the command of F/L. Chris Draper (who was alleged to have challenged Fokker—after the war—to an air duel). Half-way through December (1914) the squadron received eight 80 h.p. Gnôme-Avros and four 80 h.p. Gnôme-Sopwith Scouts.

In October it had been decided to form a defence flight at Dover, and this plan was hastened by the appearance of German aircraft over the harbour in December, 1914. Temporarily, No. 2 Squadron (now No. 202) performed this duty, but at the end of December four Avros, under the command of F/L. J. T. Babington, took over and were joined in January by "A" Flight. "C" Flight, at Newcastle, operated as an independent unit.

Having taken Bruges and Ostend, by November the Germans came within the operational range of aircraft based in Britain, and a force was mobilized at Dover to make projected raids. No. 1, mustering eight aircraft on the morning of February 11th, crossed the Channel in company with No. 2 (202) Squadron and various seaplanes and flying-boats collected for the occasion.

At about 9 a.m., off Nieuport, a dense snow-cloud was encountered and all the machines, with the exception of one from No. 1 and another from No. 2 Squadron, returned to base. F/L. F. K. Haskins of No. 1 struggled through the snowstorm and attacked the guns at Slype while under heavy fire.

A raid by 26 aircraft, including five from No. 1, was more successful on the following day, but on the 16th the first casualty was sustained. F/L. E. G. Rigall, flying the famous Avro 504 numbered 875, which had taken part in the Friedrichshafen raid in the previous November, failed to return. It appears certain, however, that in these early operations—some of which were at night—at least one submarine, the U.14, was hit and severely damaged.

These raids were brought to a finish owing to the necessity of sending an air unit to the Dardanelles. No. 3 Squadron was accordingly withdrawn and No. 1 took over.

*(Left) Royal visit in 1915: In the group in front of the Morane Parasol, Queen Elizabeth of the Belgians and Princess Alice of Teck are chatting with Sqn. Cdr. Longmore and Sub-Lt. Warneford, V.C. On the right are Prince Alexander of Teck and Flt. Cdr. S. V. Sippé. (Right) F/L. G. M. Dyott, one of the first officers to be posted to the squadron; in the background is the Déperdussin monoplane which he used to fly in 1911.*

The unit flew overseas on February 26th, 1915, and occupied the airfield at St. Pol. Squadron strength on arrival abroad was : 15 officers, including four observers; five Avro 504s; one Vickers Fighter and one Bristol two-seater.

Low cloud frustrated W/C. Longmore and F/L. Dyott on the first operation flown from the new station, but on March 7th, 1915, six aircraft, led by Longmore, reached Ostend and bombed the submarine base.

Bombardments of submarine bases and other targets on the Belgian coast were the chief preoccupations of the squadron at this time, and the following account gives a good idea of a typical raid. On March 24th, 1915, five Avros, under the leadership of Sqn. Cdr. I. T. Courtney (who retired as a group captain in 1932), set out for Hoboken, some 100 miles distant. Fog and cloud were encountered on the route and only Courtney and F/L. Rosher got through to the target area. Two pilots returned, having lost their way, and the fifth—F/L. Crossley-Meates—force-landed in Holland with engine trouble. Sqn. Cdr. Courtney dropped his four 20-lb bombs across the submarine yards from 350ft and Rosher released his from 1,000ft. Both returned safely to base.

For the bombardments of the Belgian coast, W/T.—then in its infancy—was used. Frequently, however, the equipment would not work and on at least one occasion, when Sqn. Cdr. Courtney had 2nd Lt. J. H. D'Albiac (now Air Marshal Sir John D'Albiac, Ret.) on board as an observer, communication between the Maurice Farman and H.M.S. *Bustard* was by signalling lamp.

From London Airport, of which he is Commandant, Sir John writes of this period in the squadron's history : "I and another Royal Marine officer—Innes Baillie—joined No. 1 Wing, R.N.A.S., as air observers at Dover early in February, 1915. The wing, which in those days was hardly as large as a present-day squadron, was commanded by W/C. Arthur Longmore and amongst the pilots were Spenser Grey, Sippé, Bigsworth, Evill, Haskins, Dyott, Rosher and Huskisson.

"Three weeks after I joined, the wing moved to an aerodrome at St. Pol, just outside Dunkirk, where it operated against enemy forces which were in occupation of the Belgian coast from the Dutch frontier to Nieuport. Our main duties included reconnaissance of harbours and coastal roads, photography, artillery spotting (both for H.M. ships and for land batteries) and bombing attacks. Our aircraft were a collection of Avro 504s, Vickers pusher two-seaters (known as the Gun Bus) and a Blériot monoplane.

"At that time, flying was still very much of an adventure, and in looking back on those early days of air warfare one of my main impressions—and I'm certain that it is one which most old pilots will agree with—is how uninformed and untrained we all were compared the young officer joining his operational squadron today. It is true that with technical development and improved equipment the whole business of flying has become more complicated, but, even so, I doubt whether the fundamentals of pure flying are more difficult now than they were then. In fact, in many respects they are far simpler.

"The risk of a forced landing, always a very real one in the past, is now negligible. Increased power and aerodynamic efficiency now enables flying to be carried out in all weathers, whereas in the early days our operational potential was often dependent on the angle of the wind-sock. Finally, the value of radio telecommunications and modern navigational aids can hardly be over-emphasized. Having served for a tour as a pilot in a night bomber squadron between the wars, I can speak feelingly on this.

"When we observers joined No. 1 Wing, the only Service training of any sort we had had was Drill, with a capital "D," on the barrack square at the Royal Marine Barracks at Eastney—and, in less than three weeks, here we were carrying out operational sorties against the enemy. Our trade had to be learned the hard way and in this respect we were perhaps less fortunate than our pilots, who at least knew how to fly. However, by spending all our available spare time learning such things as the Morse code, semaphore, map reading, etc., we gradually picked up the rudiments of our business and by degrees I think we convinced our pilots that our journeys were really necessary.

"None of our aircraft could ever, by the wildest stretch of imagination, be regarded as war machines and this was particularly the case as regards their armament. Initially we carried revolvers and 12-bore sporting guns with a type of chain shot which was supposed to be particularly lethal against Zeppelins. Fortunately, the few enemy aircraft we did meet were not very much better armed than we were, and for a time we hardly interfered with each other. A.A. fire, on the other hand, was particularly fierce from German naval guns mounted on the coast and, at our operational height of 6,000 or 7,000ft, most unpleasant.

"For artillery registration we used Aldis lamps and Sterling spark-transmitter W/T sets, and we passed our sightings of fall of shot with reference to a lettered grid overlay and later a clock code; messages from the ground were by ground strips or lamp. Everyone was imbued with a high sense of enthusiasm and comradeship. It was all grand fun and we were young enough to enjoy it."

About this time (April, 1915) the activities of the squadron were also directed against the German Zeppelin airships stationed in the newly conquered Belgian territory. Towards the end of the month it became known that L.Z. 37, L.Z. 38 and L.Z. 39 had all arrived in the Brussels area.

On May 17th all three airships set out to raid the British and French coast towns : L.Z. 37 attacked Calais and L.Z. 38 Ramsgate. L.Z. 39 had to return and was caught by three pilots of No. 1 Squadron, who all got to close range. These were Sqn. Cdr. Spenser Grey, Flt. Cdr. Bigsworth and Flt. Sub-Lt. Warneford. Bigsworth succeeded in getting above the Zeppelin and dropped four 20-lb bombs along its back without, however, causing vital damage.

A more successful attack came during the night of June 6-7th when the same three airships left their sheds in Belgium for a raid on Great Britain. It so happened that night that four pilots—Warneford, Rose, Wilson and Mills—had been detailed in pairs to attack the Zeppelin sheds at Bercham St. Agathe and Evère.

*Sqn. Cdr. Spenser Grey, who, with Flt. Cdr. Bigsworth and Sub.-Lt. Warneford, made a concerted attack on the Zeppelin L.S.39 in May, 1915.*

*F/L. Rigoll, the first pilot of the squadron to lose his life in action. He is seen in the open bucket-seat of a Grahame White "box kite."*

# No. 201 SQUADRON R.A.F.

While on his way to Bercham St. Agathe, Warneford sighted the L.Z. 37 in the direction of Ostend; he at once gave chase and caught up with it over Bruges. Climbing 150ft above the great envelope, he released his six 20-lb bombs. As the last bomb left its rack, there was a terrific explosion and the airship blew up, turning the Morane over on its back.

After regaining control Warneford saw the airship in flames on the ground. At this point he had to force-land, through engine failure, in enemy territory. In 1915 aero-engines were simple, if temperamental, devices and he was able to effect a repair and take off from the field in which he had landed. He finished the operation by making another forced landing in thick fog at Cap Gris Nez. Warneford's companion, Rose, lost his way and turned his Morane upside down in a wheat-field near Cassel.

Wilson and Mills, flying Henry Farmans, reached Evère after a 100-mile trip in the dark. Wilson arrived first and, after circling until first light, dropped three 65-lb bombs from 2,000ft. Mills attacked ten minutes later, releasing his 20-pounders from 5,000ft. Suddenly there was a great blaze on the ground as L.Z. 38—the first aircraft ever to raid London—went up in flames.

For his share in the night's work Warneford was awarded the Victoria Cross; and for a tribute to this pilot and his machine we may again turn to Sir Arthur Longmore's *From Sea to Sky:* "Here was a case of a man who knew absolutely no fear, and my problem was to keep him alive as long as possible and use him to do the maximum damage to the Germans. I therefore allotted him a single-seater Morane and gave him a roving commission. This aircraft was one of the first to be fitted with a machine-gun firing directly ahead through the airscrew, the blades of which had steel deflectors fitted to turn aside those bullets (about one out of every ten) which would otherwise have pierced the blades. Roland Garros, a French fighter ace, had some considerable success with a machine so fitted. It was later that the interrupter gear was developed which actually synchronized the firing of the gun to avoid shooting away the blades of the airscrew.

"With his Morane, Warneford spent many hours over the front line, attacking German observation aircraft with varying success, and usually came back with a good few bullet holes in his machine, so much so that I managed to get him a second Morane for use when the other was out of action."

Warneford was to lose his life a few weeks later while flight-testing another aircraft.

In August, 1915, there was a reorganization of the R.N.A.S. and No. 1 Squadron, now renamed No. 1 Wing, returned to Dover. This move, however, proved very much a temporary one, for within a fortnight No. 1 was back at Dunkirk in order to co-operate in the bombardment of Zeebrugge. The unit's share of the operation was to supply an air cover of five aircraft.

Having been so successful in destroying craft cruising in one medium, No. 1 then turned its attention to another—the submarine. On August 26th Sqn. Cdr. Bigsworth, flying a Henry Farman, was on his way to attack a seaplane carrier reported to be off Zeebrugge when he saw a U-boat cruising on the surface. Attacking from 500ft, he released his two 65-lb bombs, the concussion from which threw the Farman out of control. When last seen, the submarine was disappearing tail-first.

In these days of radar and of split-second scrambles to 40,000ft it is interesting to recount how such affairs were conducted in early 1916. On the evening of January 31st, information was received of Zeppelins approaching England. Three pilots stood by their aircraft all night, ready to take off if an airship was sighted off Dunkirk. In the morning, at 0605 hr, ten Nieuports left at three-minute intervals to take up positions five miles out to sea, at a height of 10,000ft, to intercept any returning raiders. All the aircraft carried a number of 16-lb bombs with the exception of one, which was armed with Rankin darts. Fuel for two and a half hours was carried, but the patrol was abandoned at 0745. Thick mist made navigation and landing difficult. One pilot landed on the sea and was picked up 20 miles north-east of Dieppe; another made a cross-wind landing on the sands and capsized in the process. Five others managed to get down on the beaches safely and flew home later, after the mist had cleared.

In March, 1916, came another reorganization. No. 1 Wing was grouped into flights; Nos. 1 and 2 Flights becoming "A" Squadron, which eventually was renamed No. 1 (Naval) Squadron. No. 1 Flight had two-seater Nieuports for reconnaissance work and No. 2 Flight single-seater Nieuports for fighting and anti-Zeppelin duties. A bombing flight, which had on charge seven twin-engined Caudrons, was also temporarily manned and maintained by No. 1.

In these days of efficient photographic reconnaissance and integration of European air forces it is interesting to hark back to 1916 and see how such things were done then. At 0645 hr on April 19th, Flt. Sub-Lt. Norton, with Sub-Lt. Furniss as observer, set out with special instructions to locate and *sketch* Houttave airfield. This was accomplished successfully and the airfield bombed before dawn the next morning by a combined force of eight British, ten French and eleven Belgian aircraft, escorted by four British Nieuports, nine French and five Belgian fighters. No. 1's share in the attack was performed by five Caudrons.

Recorded history makes it difficult to decide exactly when or where the first enemy aircraft fell to No. 1's guns. F L. Ferrand flying an F.B.A. flying-boat is credited with a German Albatross on November 28th, 1915, and Flt. Sub-Lt. Graham shot a seaplane down in December, 1915. It is not clear, however, whether No. 1 was ever equipped with any F.B.A. flying-boats, or if Graham was actually with No. 1, or only operating with an associate unit.

On February 29th, 1916, Sub-Lt. Simms was undoubtedly successful. On patrol in his Nieuport scout he chased a German aircraft over Dixmude and shot it down in flames in front of the Belgian-held trenches. The same pilot shot down a two-seater seaplane near Zeebrugge in April of the same year, but he himself was lost on a fighting patrol in May.

During the early summer of 1916 the German air force was making continuous attacks on the town of Dunkirk, and it was arranged that protective patrols should be shared between No. 1 Wing and a French squadron, stationed at Furnes. Hardly had this arrangement come into being when the French unit was called away to the defence of Verdun and "A," or No. 1, Squadron took up its quarters at Furnes. By careful integration of the fighting patrols of the R.N.A.S. the Germans were denied access to Dunkirk.

It was in June, 1916, too, that the unit received its first Sopwith Triplane. This fighter, with its 110 h.p. Clerget rotary engine, was the best ever—up to then. The squadron was so pleased with its new toy that it was sent up on an interception within a quarter of an hour of arrival. The squadron diary records its ability to reach 12,000ft in 13 minutes. Other figures for the Triplane are: maximum speed 116 m.p.h.; service ceiling 20,500ft; gross weight 1,415 lb; disposable load 238 lb.

The start of the Battle of the Somme in July, 1916, brought a marked decrease in enemy air activity in the coast areas. The R.F.C. was fighting so hard for air supremacy on the Somme that the Germans had to concentrate all their strength for that battle. Every effort was made to stir them into activity in the Dunkirk sector, but it was October before any increased resistance was noticeable. By that time the Somme battle had died down.

On the 20th four air combats took place, in one of which F/L. Leather shot down a twin-engined seaplane off Ostend. The same day F/L. Norton, with the aid of Le Prieur rockets, destroyed

*Sub.-Lt. R. A. J. Warneford, who won the squadron's first Victoria Cross.*

*Sub.-Lts. Mulock and Beard, in their Nieuports, about to take off to attack the Zeppelin airship sheds at Evère, near Brussels, in 1915. The six 20 lb bombs can be seen stowed below the fuselage.*

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# No. 201 SQUADRON R.A.F.

an enemy kite balloon. (These rockets were an invention of Lt. Prieur of the French Navy; they were attached to the interplane struts and fired electrically; their most effective range was 400ft. Special phosphorus bombs were also employed against kite balloons.) At the end of 1916 the unit reverted to its original title of No. 1 Squadron, R.N.A.S., and early in the new year was posted to operate with the R.F.C. Major-General Trenchard (now Marshal of the Royal Air Force Lord Trenchard) had asked for the assistance of four more Naval squadrons in addition to No. 8, which had become attached to the Royal Air Force in the previous October.

Under the command of Sqn. Cdr. Haskins, and equipped with 16 Sopwith Triplanes, the squadron moved from Furnes to Chipilly on January 15th to be attached to the 14th (Army) Wing, No. 4 Brigade. For some weeks the squadron concentrated on target practice and formation flying, and it was early April before the first offensive patrol was flown. On this operation no enemy were seen, but the next day Flt. Cdr. Dallas shot down an Albatross. Dallas got another on the following day and F/L. Clayton and Flt. Sub-Lt. Culling each got yet another.

In the Battle of Arras (April 9th to May 4th) No. 1 served with the 13th (Army) Wing and operated from la Bellevue. During the battle the squadron's duties chiefly consisted of hostile-aircraft patrols in formations of three to six machines, but, on occasions, providing escorts for reconnaissance, bombing and photographic machines.

An idea of the intensity of operations can be gauged from the following figures. In the nine days between April 22nd and May 5th, 95 offensive patrols were flown and 175 enemy aircraft engaged, out of which four were destroyed and a further 12 seen to go down out of control.

An air battle, typical of the period, took place at 0745 hr on May 4th, when a formation of 10 Sopwith Triplanes led by Flt. Cdr. Gerrard encountered some 20 enemy fighters over Moorslede. In this "free-for-all," in which some British Nieuports and S.E.5s joined, a hostile machine on the tail of a Nieuport was attacked by Gerrard, who fired 60 rounds from his single Vickers gun into the enemy at point-blank range. The German fighter rolled over and over for 3,000ft and then fell vertically. Another aircraft was then attacked by Gerrard in conjunction with one of the Nieuports. Each fired about 30 rounds—the Nieuport from above and the Triplane from below—and the enemy was seen to crash. Three more were attacked by Flt. Sub-Lt. Ramsey over Menin and all three were seen to go down out of control. Although Gerrard's lateral controls were completely shot away he managed to land safely.

On June 14th, 1917, Sqn. Cdr. Haskins left the squadron to return to England and assume command of the Cattewater seaplane station near Plymouth. Flt. Cdr. R. S. Dallas took over the unit.

At about this time the R.N.A.S. at Dunkirk were having considerable difficulty in maintaining the naval squadrons attached to the R.F.C., despite a reduction in squadron establishment from 18 to 15 aircraft. No. 1 Squadron was eventually brought up to its original establishment at the end of August, 1917, by the transfer of three Triplanes from No. 10 (Naval) Squadron (which was then in process of being re-equipped with Sopwith Camels). A number of pilots came to No. 1 from No. 9 (Naval) Squadron when that unit ceased to be attached to the R.F.C. in September of the same year.

Meanwhile the third Battle of Ypres opened on the last day of July, 1917, and No. 1, which was still serving with No. 11 Wing of the Second Brigade, was detailed on the first day of the battle to make low-flying attacks against the German airfields at Coucou and Reckem. Three of the 11 available pilots put in three patrols and the total war hours flying for the day came to over 25. All the Triplanes were damaged by ground and air fire, some very severely.

The sixteenth day of the battle was a very successful one for the squadron, three enemy aircraft being shot down before 0900 hr. During his first attack on airfields at Chateau du Sart and Mouvesux between 0440 hr and 0530 hr, F/L. Minifie destroyed a hostile scout. At 0700 hr Flt. Sub-Lt. Rosevear got one of a formation of four aircraft which he and a French Spad attacked and the C.O. got another at 0845 hr. This last enemy aircraft Sqn. Cdr. Dallas chased down to ground level, eventually watching it crash into a hedge.

By now the pilots were very efficient in ground-strafing attacks, and the squadron diary records instance of German troops being attacked in shell holes from a height of only 10ft. One of the pilots with No. 1 at the time was F/L. S. M. Kinkead, who was to become (in 1927) one of the Schneider Trophy team and who lost his life whilst making an attempt on the world's speed record at Calshot.

After a long period of very hard fighting the squadron was now (November, 1917) due for a rest. All the pilots who had served for less than one month were transferred to No. 8 (Naval) Squadron, and the unit ceased to be attached to the R.F.C. and returned to Dover to be re-equipped with Sopwith Camels. This stay in England was not as restful as it might have been, for on at least three occasions the pilots were scrambled to intercept German bombers heading for London.

By February 16th, still under the command of Sqn. Cdr. Dallas, No. 1 was back on the Continent and on March 27th, 1918, five days before the amalgamation of the R.F.C. and R.N.A.S. as the Royal Air Force, it was again attached to the R.F.C. On that memorable date—April 1st, 1918—when the R.A.F. came into being, No. 1 Squadron, R.N.A.S., became No. 201 Squadron, R.A.F. The last decisive victories under the old designation included one against a drifting German observation balloon with a straw dummy observer on board and five enemy aircraft destroyed in one day—March 21st.

Sqn. Cdr. Dallas, now Major Dallas, left to command No. 40 Squadron and Major C. D. Booker took over No. 201.

The change came at a time of very hard fighting. The Germans were making their last desperate attempt to break through the Allied defence lines. Every day, in flying weather, the squadron was in action. On the 6th, for instance, 14 Camels led by Ridley and Rosevear—both now captains—engaged an enemy formation of 12 over Bouchoir. In a fierce engagement lasting about 15 minutes Capt. Rosevear destroyed one and Lt. Spence another, while Capt. Kinkead shot a third down out of control. On the evening of the same day Lt. Findlay attacked four Fokker Triplanes over Maricourt, which were reinforced by a further four. His Camel was badly knocked about, two of the landing-wires being severed. Gradually losing height and jinking all the time, he tried unsuccessfully to escape. Finally he arrived over No Man's Land at less than 50ft, with all controls shot away, engine stopped and cockpit riddled. He crashed between our first- and second-line trenches and was promptly shelled by the German artillery; but he escaped untouched.

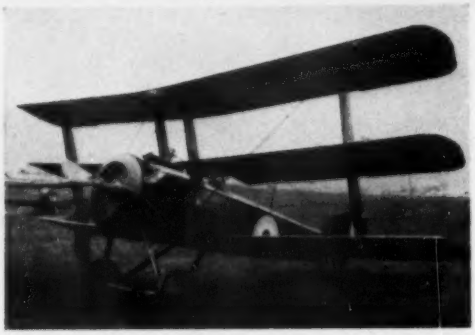
In May one of the squadron's new duties was the escorting of D.H.4 bombers of No. 57 Squadron on day raids. During the month approximately 200 enemy aircraft were encountered, resulting in 112 individual combats. In the course of these air battles the squadron scored eight enemy aircraft destroyed and

*DUNKIRK, 1915: Among the officers in this group are 2nd Lt. J. H. D'Albiac, Flt. Cdr. A. W. Bigsworth, Sub.-Lt. Mulock, F/L. F. K. Haskins, F/L. D. C. S. Evill and W/C. A. M. Longmore. This photograph, and that of the two Nieuports taking off, is lent by Sir Arthur Longmore.*

*Lighter moment with a highly experimental French aircraft on Dunkirk airfield in 1915. A photograph from Major S. V. Sippés' scrapbook. The British officers in the group include Coleman, Huskisson, Sippé and Evill.*

# No. 201 SQUADRON R.A.F.

*The late Brig.-Gen. R. M. Groves, who, as W/C. Groves, commanded the squadron in the early part of 1916. The R. M. Groves Memorial Prize is competed for annually at the R.A.F. College, Cranwell.*



*The Sopwith Triplane was the single-seat fighter used by the squadron in 1917.*

**Commanding Officers from 1914 to 1919**

| | |
|---|---|
| W/C. A. M. Longmore ... ... ... ... ... | 15.10.14 |
| W/C. R. M. Groves ... ... ... ... ... | 19.1.16 |
| Sqn. Cdr. F. K. Haskins ... ... ... ... ... | 23.4.16 |
| Major R. S. Dallas ... ... ... ... ... ... | 14.6.17 |
| Major C. D. Booker ... ... ... ... ... | 18.3.18 |
| Major C. M. Leman ... ... ... ... ... | 18.8.18 |

a further 16 are recorded as being driven down out of control.

The squadron diary for August 8th, 1918, gives a graphic picture of the work No. 201 was doing at the time. This day was the opening of the Battle of Amiens. Starting at 0530 hr aircraft, carrying 4×25-lb bombs each and a full load of ammunition, went up at intervals of 30 minutes throughout the day bombing and machine-gunning enemy troops, transport, machine-gun emplacements, gun teams and ammunition wagons from 50-100ft. Direct hits were obtained on three ammunition trains, four bombs were planted in the midst of six aircraft on Faucourt airfield, thousands of troops retreating in disorder were bombed and machine-gunned, and four bombs dropped on a dump near Coppy caused an enormous explosion. While shooting-up German infantry, Lt. MacKay was himself shot down 300 yards behind the enemy lines. Making a dash for freedom, he met one of our tanks and climbed inside. Finding it to be going in the wrong direction he hopped out again and, under intense fire, made off westward, eventually to rejoin the squadron.

Four days later No. 201 lost its commanding officer, Major Booker. He was shot down while showing a newly joined pilot the battle lines. Command was assumed by Major C. M. Leman.

The last remaining sectors of the vaunted Hindenburg Line were captured in the Battle of Cambrai, which opened on September 27th, 1918. Orders for the day said: "No. 201 Squadron will support the infantry attack, four machines being detailed for each Corps front." The following is from a typical report: "Capt. Gates dropped 4×25-lb bombs from 1,000ft on M.G. emplacements S.W. of Graincourt and at the same time saw Lt. Carter's machine crash between our shrapnel and H.E. barrage. Lt. Paton dropped 4×25 lb on stationary transport and then swept the road with M.G. fire three times; 2nd Lt. Tearle's four bombs landed within 15 yards of an A.A. gun and he used up his ammunition in attacks on troops from 600ft; 2nd Lt. Green also bombed and machine-gunned stationary transport from 800ft; 2nd Lt. Nicholas expended his bombs on billets and a road junction. He then fired 800 rounds on enemy troops near Graincourt and finished his ammunition by attacking the enemy in their trenches. He saw one of our tanks approaching the wreck of Lt. Carter's machine. All the above occurred between 0745 and 0830 hr on the morning of September 27th. This intensity was kept up the whole day."

Just before the end of the war No. 201 was credited with its second Victoria Cross. It was won by Major W. G. Barker, D.S.O., M.C. The citation reads:

"On the morning of October 27th, 1918, this officer observed an enemy two-seater over the Foret de Moral. He attacked this machine, and after a short burst it broke up in the air. At the same time a Fokker biplane attacked him, and he was wounded in the right thigh, but managed, despite this, to shoot down the enemy aeroplane in flames.

"He then found himself in the middle of a large formation of Fokkers, who attacked him from all directions, and was again severely wounded in the left thigh, but succeeded in driving down two of the enemy in a spin.

"He lost consciousness after this, and his machine fell out of control. On recovery he found himself being again attacked heavily by a large formation, and singling out one machine, he deliberately charged and drove it down in flames.

"During this fight his left elbow was shattered and he again fainted, and on regaining consciousness he found himself still being attacked, but, notwithstanding that he was now severely wounded in both legs and his left arm shattered, he dived on the nearest machine and shot it down in flames.

"Being greatly exhausted, he dived out of the first fight to regain our lines, but was met by another formation, which attacked and endeavoured to cut him off, but after a hard fight he succeeded in breaking up this formation and reached our lines, where he crashed on landing.

"This combat, in which Major Barker destroyed four enemy machines (three of them in flames), brought his total successes up to 50 enemy machines destroyed, and is a notable example of the exceptional bravery and disregard of danger which this very gallant officer had always displayed throughout his distinguished career."

The last aircraft to fall to the squadron in the 1914-18 war was shot down on October 10th by Lt. Parkinson, who was on patrol over Clermont Wood. One of four Fokkers that attacked him from above overshot in its dive and gave Parkinson a chance to get in a long burst at 50 yards.

At the time of the armistice, November 11th, 1918, No. 201 was at La Targette. On January 23rd it was reduced to cadre, after handing its aircraft over to No. 203 Squadron. Returning to England on February 15th the squadron was stationed at Lake-down until it was disbanded on the last day of 1919.

(*To be continued*)

*(Left) Capt. Kinkead, a pilot of No. 201 in 1918 and a member of the successful Schneider Trophy team in 1927.*

*(Right) Major W. G. Barker, D.S.O., M.C., who, while attached to No. 201 in 1918, won the second Victoria Cross for the unit. He was flying one of the very few Sopwith Snipes to see service in the 1914-18 war.*

# THE AERONAUTICAL BOOKSHELF

## Unvarnished History

*"The Struggle for Europe," by Chester Wilmot. Collins, St. James's Place, London, S.W.1; 766 pp.; illustrated with 51 maps. Price 25s.*

HAD this book been written in the style of so many histories of World War II, we should have derived sadistic pleasure from describing how we struggled valiantly through 766 pages of *The Struggle for Europe*. But it is not that kind of book; here, for the first time, are the facts about World War II, unvarnished by wishful thinking, with no attempt to praise one man, one Service or one country at the expense of any other, and with plenty of honest-to-goodness criticism.

As *The Struggle for Europe* has been widely reviewed elsewhere in general terms, we shall concern ourselves solely with the air side of the story, which is commendably complete and balanced, except for the strange omission of any mention of the Luftwaffe's surprise last-fling attack on the Allied air forces in France on New Year's Day 1945, which cost us 260 aircraft destroyed and damaged. From the Battle of Britain to D-Day, we can trace the gradual build-up of Allied air power, which enabled us in 1944 to photograph, map and make detailed models of every inch of the invasion coastline, while protecting completely our own invasion bases from attack or reconnaissance.

Mr. Wilmot's description of Allied airborne operations on D-Day is particularly good—which is hardly surprising, as he accompanied the 6th Airborne Division as a B.B.C. war commentator. The subsequent effects of Allied tactical bombing and rocket attacks are perhaps best summed up by German Panzer General Bayerlein, who told how "The planes kept coming over as if on a conveyor belt, and the bomb carpets unrolled in great rectangles. My flak had hardly opened its mouth when the batteries received direct hits which knocked out half the guns and silenced the rest. After an hour I had no communication with anybody, even by radio. By noon nothing was visible but dust and smoke. My front lines looked like the face of the moon and at least 70 per cent of my troops were out of action—dead, wounded, crazed or numbed. All my forward tanks were knocked out, and the roads were practically impassable."

Allied strategic bombing does not get so much praise from Mr. Wilmot, though he emphasises many indirect benefits from it. For instance, output of Me 163 rocket-fighters had reached 80 a month by the autumn of 1943; then the R.A.F. destroyed a plant in Hamburg which was the sole producer of part of the rocket fuel, and the 163 project had to be abandoned. Similarly, Allied mass raids on German fuel and oil plants forced Galland to use up his fighter force piecemeal in continuous small-scale actions, so preventing its planned build-up to a force of 2,500 aircraft, intended to inflict staggering losses on the Allied bomber fleets in one "grand strike." As for Hitler's "miracle weapons": Mr. Wilmot points out that "Even after 5,000 V-bombs had fallen on Antwerp and its environs, the total damage to docks and installations was no greater than might have been caused in one conventional raid by a hundred bombers."

*The Struggle for Europe* is more than just a model of readable history; for if we take to heart its many lessons of war, there may still be time to prevent ourselves losing the peace.

## Recognition Trio

*"The Air League Recognition Manual, by C. H. Gibbs-Smith, M.A., F.R.S.A. Putnam and Co., Ltd., 42 Great Russell Street, London. Price 10s 6d.*

*"Jet Aircraft," by R. Das and H. Volker. Anglo-French Literary Services, Ltd., 72 Charlotte Street, London, W.1. Price 5s.*

*"Military Aircraft of the U.S.S.R.," by Charles Cain and Denys Voaden. Herbert Jenkins, Ltd., 3 Duke of York Street, London, S.W.1. Price 3s 6d.*

WELL-KNOWN to spotters as the author of three very useful war-time recognition books, Mr. C. H. Gibbs-Smith has completed the quartet with a new manual written for the Air League. It is designed as a primer and reference-book for the student of recognition, who will find it a reliable guide to the shapes and functions of the 180 types covered in its 240 pages. Aircraft have been classified in the simplest way possible (*e.g.*, small—fast, medium—slower) and statistical facts kept to a minimum.

Mr. Gibbs-Smith relies on photographs, three-view silhouettes and caricatures by Charles Sargeant to make a visual impression on his readers. Less conventional but equally effective are his deft word-pictures of aircraft: to the author, the Valiant's fuselage is "a great tapered torpedo with a snake's head," and the Sabre is a "perky U.S. fighter very much like a flying fish, with a mouth perpetually agape."

We were sorry to spot an error on the fly-leaf, where a silhouette of the Bristol Freighter is named as the Blackburn and General Aircraft Universal Freighter, which (to quote the author) is "the most easily recognised aircraft in the world." This "brick" appears to be an isolated one, though the speed-ranges quoted for some types are open to query. All in all, however, the book is good value.

Another book for the general reader is *Jet Aircraft*, the fifth in the *Picture Encyclopaedia* series. Over 50 jet aircraft of international interest are introduced by means of silhouettes, small data tables and neat black-and-white sketches by R. Das. The drawings are the better part of the book; too many "guesstimations" are inserted to inspire confidence in the author's claim that exact figures are used. To our knowledge, there is no factual basis for quoting such speeds as 800 m.p.h. for the Fairey F.D.1, 670 m.p.h. for the Avro Canada Canuck, 590 m.p.h. for the Avro 707B, 700 m.p.h. for the Boulton Paul P.111 and 597 m.p.h. for the English Electric Canberra. And there is no such aircraft as the "Supermarine 535 Swift" described in this attractive but partially misleading booklet. The text, incidentally, is in English, French, Dutch and German.

Russian military aircraft are the subject of the book by Charles Cain and Denys Voaden. In his foreword, Mr. Peter Masefield congratulates the authors on a "Sherlock Holmes" job of real value in following up clues and compiling "probably the fullest account available anywhere of the equipment and status of Soviet military aviation." Wisely, they have not over-emphasised the significance of unconfirmed reports. Facts and figures are neatly presented and well illustrated with photographs and silhouettes. The artist, Björn Karlström, has also contributed caricatures.

## Who, Where, What

*"The Aeroplane Directory of British Aviation, 1952," Temple Press, Ltd., Bowling Green Lane, London, E.C.1; 434 pp. Price 15s.*

THIS new edition of the standard who's who, who's where and what's what in British aviation introduces a number of important changes. To start with, the page size is bigger, so that although the directory contains many more entries than before it is less bulky. Secondly, and even more welcome, there is now a very complete index at the back, covering every section of the book with the exception of "who's who," which is arranged alphabetically in any case.

The directory of the aircraft and allied industries has been split into many more sections to facilitate reference, and a large number of companies appear for the first time. New sections list such things as overseas licensees of British aircraft and engines, V.C.s of the Air and details of the auxiliary Services, including the Royal Observer Corps. The result could hardly be more complete, up-to-date and useful.

## OTHER BOOKS RECEIVED

*Teach Yourself Motoring*, by Dudley Noble. English Universities Press, Ltd., St. Paul's House, Warwick Sq., London E.C.4. Price 6s 6d.

*Aircraft Maintenance*, by D. J. Brimm and H. Edward Boggess. Sir Isaac Pitman and Sons, Ltd., 39 Parker Street, London, W.C.2. Price 40s.

*Air Transportation Management, its Practices and Policies*, by J. L. Nicholson. Chapman and Hall, Ltd., 37 Essex Street, London, W.C.2. Price 52s.


## Books Recommended by "FLIGHT"

**Fellowship of the Air** (Jubilee Book of the Royal Aero Club). By B. J. Hurren. Price 30s net; by post 30s 11d.

**Mechanics for the Home Student.** By Eric N. Simons, in association with W. D. Burnet, B.Eng., Lecturer in Mechanical Engineering at Sheffield University. Price 7s 6d net; by post, 7s 10d.

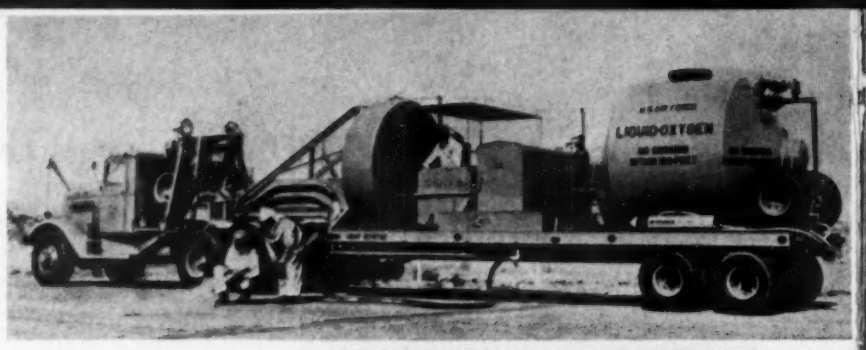
**A Racing Motorist:** His Adventures at the Wheel in Peace and War. By S. C. H. Davis of *The Autocar*. Price 10s 6d net; by post, 11s.

**Rallies and Trials.** By S. C. H. Davis of *The Autocar*. Price 15s net; by post; 15s 7d.

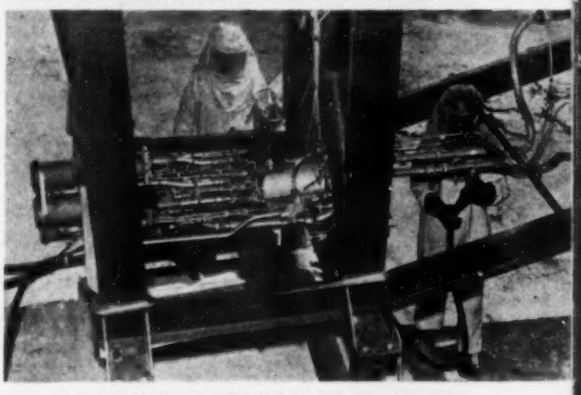
**Roads of France**—A Guide to Tourist Routes. By A. G. Douglas Clease. Price 5s net; by post, 5s 2d.

**Yachting World Annual, 1951-52** (Incorporating *Yachtsman's Annual*). Price 30s net; by post, 31s.

Obtainable at all booksellers or direct from the Publishing Dept., Dorset House, Stamford St., London, S.E.1.




*The 12½-ton rocket-servicing truck described below and (right) its two-man crew in their protective clothing refuelling an XF-91 motor (built by Reaction Motors, Inc.) on a test-rig.*



# ROCKET REFUELLER

FOLLOWING their design of the first American experimental rocket-boosted intercepter, the XF-91, Republic Aviation Corporation have delivered to the U.S.A.F. a 12½-ton servicing truck which for the first time makes possible quick, efficient fuelling of aircraft liquid-fuel rocket-motors.

In the past, such refuelling has been a lengthy and often dangerous process, as extensive safety precautions are essential to ensure that the propellants—usually liquid oxygen and water-alcohol—are not brought together prematurely with highly explosive results. The Bell X-1 was fuelled by placing it under a liquid-oxygen storage container and allowing the fuel to feed by gravity into the aircraft's tanks overnight. The Douglas Skyrocket was fuelled with liquid oxygen at a remote storage tank and then transported to its flight-test base on a special truck.

The Republic truck is able to service an aircraft simultaneously with both types of fuel and with pressurizing gas. Up to 900 gallons of liquid oxygen can be carried in the rear tank, which is double-walled and effectively insulated, making it in effect a giant vacuum flask able to keep the oxygen in its liquid state at minus 300 degrees Fahrenheit for many hours.

The 700-gallon water-alcohol tank is at the forward end of the truck, and eight nitrogen bottles are provided. Additional equipment includes a U.S.A.F. type B.8 engine-generator, fire-extinguishing system, compressor, and an electric pump. Yet the entire servicing unit can be operated by two men.

Republic's statement that "the Air Force, impressed by the rig, has been using it on *several* aircraft types" (our italics) is significant, as absence of a fast-climbing, very-high-altitude intercepter may be the most dangerous gap in America's air-defence system. No orders for rocket fighters are known to have been placed.

# PIPERS for 1952

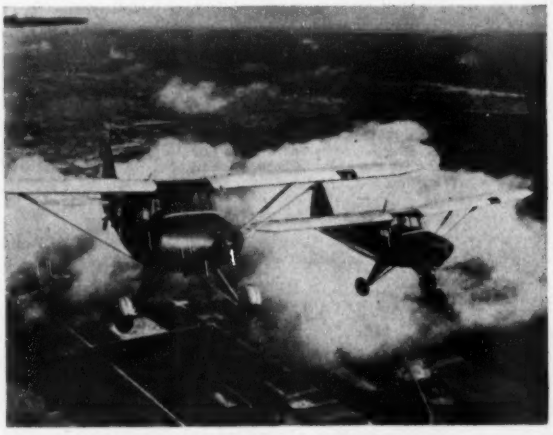
AS is the practice in the automobile industry, many American light-aircraft manufacturers are able regularly every 12 months to announce "the year's new model." The Piper Aircraft Corporation of Pennsylvania has recently put out details of the latest versions of its light four-seaters, the PA-20 Pacer 125 and PA-22 Tri-Pacer 125. These are basically similar types but, as its name suggests, the latter has nosewheel landing-gear. Variants, known as the Models 135, differ only in having Aeromatic or Sensenich c.p. airscrews.

The standard of comfort expected of American light aircraft is high, and thus the Pipers are no exception in having carefully planned cabin-air circulation, together with heating and sound-proofing. The 1952 models have two separate heaters in order to maintain cabin temperatures at a comfortable level for occupants without special clothing when outside air temperature is as low as 10 degrees below zero.

Some British manufacturers might learn from the sound-proofing arrangements of the Piper, which comprise an envelope of Fibreglass round the top, bottom and back of the cabin to provide an air seal in addition to reducing noise level. More sound-deadening materials have been added in the front of the cabin and around the firewall to reduce rumbling and vibration.

Other improvements to the latest Pacer include a 12in increase in undercarriage track and softer shock-absorbing. Forward vision is also improved on both types by the elimination of some bracing members as a result of fitting a more rounded windshield of greater structural strength. A change in the control linkage will provide lighter controls (particularly for the ailerons) in the case of the Tri-Pacer, and, incidentally, on this aircraft the rudder and aileron controls are interconnected by means of springs to permit two-control operation for all normal flying (with either the wheel or the rudder pedals alone). The springs can be over-ridden if the pilot wishes to side-slip. Provision is made for built-in radio on the left of the pilot's panel. Blind-flying instruments are now placed centrally, and engine dials and controls to the right.

Each pair of forward and rear seats has a separate door on opposite sides of the fuselage; the rear seats are quickly removable to provide a cargo space of 30 cu ft.



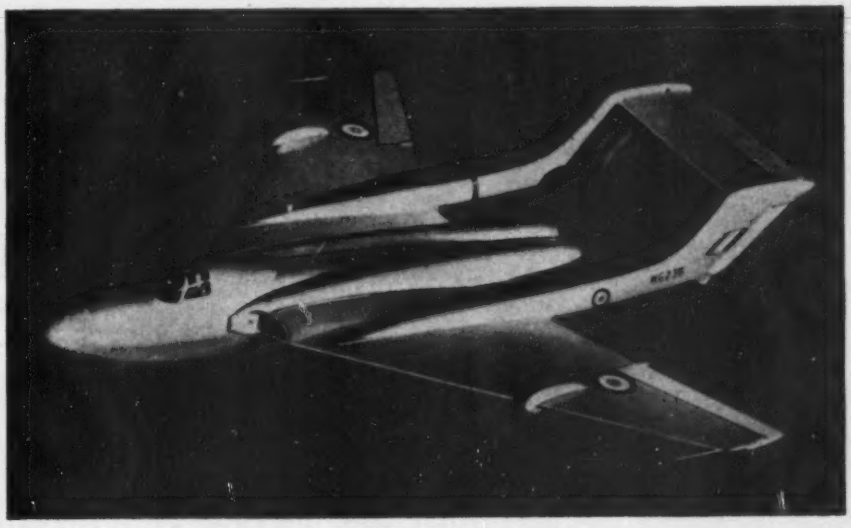
*Bicycle and tricycle: A Pacer and Tri-Pacer in close company.*

PERFORMANCE: MODELS 135 (LYCOMING 125 h.p. O-290-D)

| | Pacer 135 | Tri-Pacer 135 |
|---|---|---|
| Span | 29.3ft | 29.3ft |
| Wing area | 147.5 sq ft | 147.5 sq ft |
| Gross weight | 1,800 lb | 1,800 lb |
| Empty weight | 990 lb | 1,020 lb |
| Cruising speed (75 per cent power) | 134 m.p.h. | 132 m.p.h. |
| Cruising range | 580 miles | 580 miles |
| Stalling speed (with flaps) | 48 m.p.h. | 48 m.p.h. |
| Fuel consumption | 7.7 gal/hr | 7.7 gal/hr |
| Fuel capacity | 36 gal | 36 gal |

# PROGRESS

Rolls-Royce produce turbo-jet,
propeller-turbine and piston aero engines to suit
all types of medium and high-powered aircraft

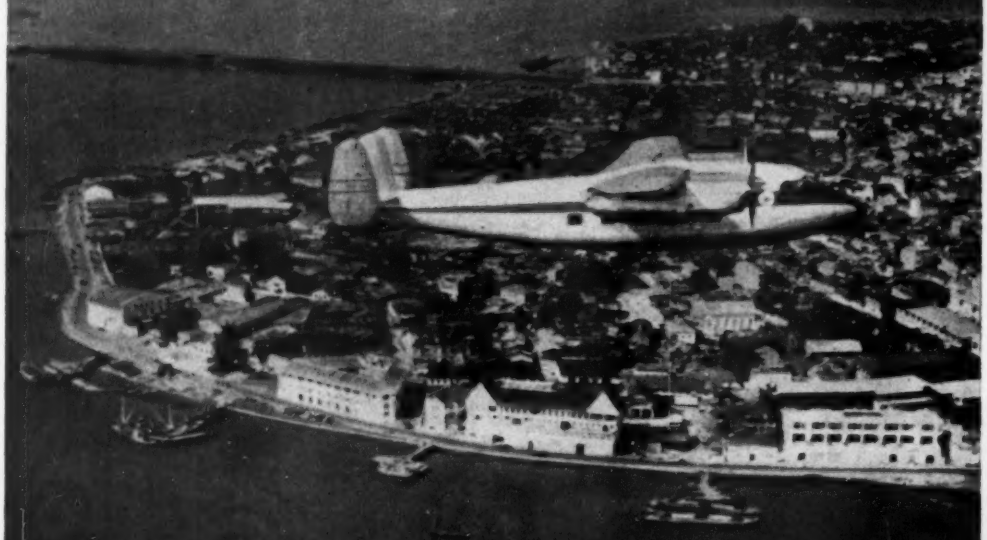


*THE DE HAVILLAND DH.110 MULTI-PURPOSE FIGHTER*
*powered by two Rolls-Royce "Avon" turbo-jet engines*

ROLLS-ROYCE
*Aero*
ENGINES

ROLLS-ROYCE LIMITED · DERBY

# MARATHON
## AIRLINERS



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HANDLEY PAGE

RADLETT LONDON READING

# CIVIL AVIATION

*AQUILA AIRWAYS, whose Solent "Sydney" is pictured here at Madeira, are to operate a scheduled flying-boat service from Southampton to Marseilles in association with B.E.A. The company, which also has five Short Hythes, at present operates routes to Lisbon, Las Palmas and Madeira in association with B.O.A.C.*

## B.O.A.C. "IN THE BLACK"

DURING the financial year which ended on March 31st B.O.A.C. made a "clear overall profit." This cheering news was announced on April 1st by the chairman, Sir Miles Thomas, who added that although the Treasury had provided for a grant of £1,000,000 for the forthcoming year, B.O.A.C. was "at last able to fly on its own wings" and did not seek the grant for its 1952-53 budget.

In a message to employees, Sir Miles said: "This is indeed a notable change from two years ago, when our losses approximated to £8,000,000 per annum. We can all justifiably feel very proud of this achievement. It has been done in the face of intense international competition and against a flood-tide of rising world costs. It is the outcome of a combination of airmanship, craftsmanship, courtesy and comradeship that redounds to the credit of everyone in the Corporation."

Final audited accounts are not yet available to show the full extent of B.O.A.C.'s progress. Earlier this year the Corporation announced that operations from April-December, 1951, had been rewarded by a surplus of £505,000—as opposed to a deficit of £3,157,000 during the comparable period of 1950. *Flight* recorded that, although the results to December were satisfactory, B.O.A.C. would still have to face the two worst traffic months of the year—"it is a debatable point whether the Corporation can keep the losses in the first quarter of 1952 under the £505,000 mark." This object has, in fact, been achieved, and the result is a credit to the efficiency of B.O.A.C.'s staff. Particularly fortunate is the fact that the announcement precedes by only four weeks the introduction of the Comet to B.O.A.C. scheduled services.

Although, in the initial stages, B.O.A.C. cannot operate the Comet in the most economical way possible, it appears that the London-Johannesburg jet services may at least break even—particularly if their "novelty" value produces the expected increase in load-factor. B.O.A.C. therefore faces the coming financial year with good prospects of making an overall profit, and of setting a world lead with its new aircraft.

## RISE IN B.E.A. TRAFFIC

FIGURES comparing B.E.A.'s activities in January this year with the same period in 1951 were published last week. They show that passengers, mail and freight carried by the Corporation increased by 29, 35 and 23 per cent respectively; the number of passengers transported during the month was 55,781, compared with 43,197 in January last year. Passengers carried during the year ending January 31st totalled 1,134,023—an increase of 24 per cent on the previous year's figure of 916,198. Despite the traffic increase, and a consequent 30 per cent rise in total revenue to £651,619, the month's loss of £353,362 represented a 14 per cent increase over the figure for the corresponding period last year.

Delay in the introduction of the Elizabethans is stated to be largely responsible for the loss, but the beginning of scheduled services with this type (on March 13th) can be expected to open a new and more profitable era for B.E.A. Mr. Peter Masefield, chief executive, confidently forecasts in the airline's magazine that "when we have these new 40-50-passenger aircraft bedded down they are going to transform our economic picture—for the better." He adds: "We are aiming at a very substantial increase in flying hours this year, compared with last—an increase of 24 per cent. Our Vikings will fly the largest number of hours—about 92,000—with our 38 Pionairs next and the Elizabethans third." Elizabethans are so far in service only on the London-Paris route, but, said Mr. Masefield, they would also be operating on the London-Milan, London-Zurich-Vienna, London-Copenhagen-Stockholm, London-Nice and London-Rome-Athens services within the next few weeks. Six had been delivered to date.

Apart from the Elizabethan introduction, B.E.A.'s biggest advance would be the network of services to be operated out of Manchester, linking the Midlands, Belfast and the North directly with the Continent, Channel Islands and the Isle of Man. Referring to these and the other services which will comprise B.E.A.'s biggest-ever summer schedule, Mr. Masefield warns employees that "Certainly we need every penny of revenue we can earn—all the more so because of the effect of the recent rise in fuel tax by 7½d per gallon." The increase would impose an extra £103,000 on U.K. domestic services in the coming year.

Looking into the long-term future, Mr. Masefield states that the Corporation's plans now include "new types which will be very much larger and faster than anything we have in service or on order at present." Orders for 21 Ambassadors and 26 Discovery-class Viscounts are the basis of the current B.E.A. re-equipment programme; the first Viscount is scheduled for delivery on October 1st this year, by which time 14 Ambassadors should be in service.

## U.K. AIRPORT ACTIVITY

DURING January, 1952, aircraft movements at United Kingdom airports totalled 10,837—an increase of nine per cent over the figure for January last year; 132,395 passengers used these airports, an increase of 28.1 per cent. Freight on- and off-loaded amounted to 3,144.2 short tons, 38.3 per cent more than in January, 1951.

London Airport handled 2,513 aircraft and 46,524 passengers, increases of 22.6 per cent and 33 per cent respectively over the corresponding month last year. At Northolt air transport movements totalled 2,787, an increase of 8.6 per cent, and 37,172 passengers, a 24.8 per cent increase. Other airports showing greatly increased passenger-handling figures over January, 1951, were Prestwick (22.7 per cent increase), Belfast (24.6 per cent), Manchester (49.8 per cent), Liverpool (23.4 per cent) and Isle of Man (27.8 per cent).

## CANADIAN FREIGHTING

GOOD results with their recently acquired Bristol Freighter are reported by Associated Airways, Ltd., who serve mining and oil industries, fur trading stations and Government departments in the Northern Territory of Canada. The R.C.A.F. have for some time used freighters, but Associated Airways are the first civil operators in the Dominion to adopt the "170."

Claiming to provide the first long-range air-freight service in Canada, the recently formed company of Dorval Air Transport, Ltd., has one C-46 and plans to acquire six more in the near future. The president of the company, which is based at Toronto, is Mr. D. D. Thompson, and its general manager is Mr. T. H. Lefebvre.

Dorval Air Transport, which is affiliated with an American C-46 operator, Slick Airways, will at first confine its activities to cargo flights between Canada and the U.S.A. with such loads as machinery and building equipment; it intends eventually to operate on a fully international basis.

In granting the company authority for its initial operations, despite objections filed by certain established operators, the Air Transport Board stated its belief that this type of service might well be exploited with success, and that it would meet a public need.

## I.C.A.O. PROGRESS

THE Third European-Mediterranean Regional Air Navigation Meeting of I.C.A.O. having recently finished its month's work at the Palais de Chaillot, Paris, it is now possible to give some brief idea of the major results achieved. Until such time as a detailed official report of the meeting becomes available, however, no more than a summary of the main agreements can be given.

An airways plan which was prepared during the October, 1951, meetings in Paris between the States concerned was discussed and

## CIVIL AVIATION . . .

will be the subject of bi-lateral and multi-lateral discussions with a view to its final approval at a meeting scheduled for the coming summer. The most complete airways system existing in Europe at the present time is that in Great Britain, although Norway, Sweden and the U.S. Zone of Germany also have airways in operation. The establishment of an efficient air-corridor system, however, involves considerable problems in the training of air traffic controllers, and in the evolution of a ground control organization. If only on this basis, it is likely that some of the smaller States will find difficulties in meeting the implementation date (September 1st, 1952), and considered opinion has it that only partial implementation of the programme will be possible within the next year.

One of the major problems attendant upon the establishment of a European network of airways is a common standard of altimeter settings. At the present time, the situation is equivocal because little has really been done since the 1948 agreement. The complexities of the altimeter setting problem were appreciated by most of the States attending the conference, and it was agreed that the Q.N.H. system should be used as from August 1st next as an interim datum for further study of the whole problem.

It was recommended at the meeting that the I.C.A.O. Council should examine the possibility of establishing a flight information centre to ensure complete exchange and the rapid dissemination of information essential to safety. Another recommendation tabled was that S.B.A. should be withdrawn in favour of I.L.S., the latter being a standard I.C.A.O. recommended aid. Whilst not disagreeing with this recommendation, the U.K. delegation asked that implementation should be delayed as British European Airways employed S.B.A. and would have the greatest difficulty in re-equipping their aircraft for I.L.S. sufficiently quickly.

Examination was given to the relative merits of Decca and V.O.R., and it was pointed out that a Decca coverage of some two million square miles of Europe already existed. I.A.T.A. tabled a demonstration plan of about 85 V.O.R. stations, but during an examination these were reduced to 33, 20 of which were, however, the subject of reservations or statements of intention by various of the States concerned. What is really required is an evaluation of V.O.R. and Decca. The Ministry of Civil Aviation have already made a preparatory evaluation of Decca, and in practice this will be very considerably amplified by the practical use of Decca by B.E.A. A full and reliable evaluation of the system should therefore be available within the comparatively near future; it is, however, doubtful if a corresponding evaluation of V.O.R. will appear in a like time.

Meteorology came in for a good deal of attention at the meeting, with particular attention being paid to the communication limitations and the imperative necessity of obtaining reliable data on upper air conditions. Radio sonde and rawind stations in the Eumed region have been increased from 74 to 93 and 43 to 93 respectively, but it was recognised that these numbers were still insufficient.

### N.A.T.O. AIR-LIFT

LATEST in the list of unusual tasks performed by Silver City Airways is the air-lifting of the complete North Atlantic Treaty Organization headquarters from Lympne to Cormeilles. The move was planned by the new Secretary-General, Lord Ismay, who intends to have every item of office equipment and files moved from the Belgrave Square headquarters and replaced in identical order in a wing of the Palais de Chaillot, Paris.

The lift, involving some 90 tons of freight, was due to begin last Monday afternoon. Three Freighters were to take part, making about 20 flights in all. The contract for moving the furniture from London to Lympne by road was awarded to Davies, Turner, Ltd., removal agents, who calculate the total cargo lifted by the Freighters as 30 pantechnicons-full.

### LORD DOUGLAS IN THE STATES

TRAVELLING as the guest of the American airlines, Lord Douglas of Kirtleside, B.E.A.'s chairman, is now making a four-week coast-to-coast tour of leading firms in the American aircraft industry. One of the main objects of his visit is to study progress in the design and construction of large helicopters such as the Piasecki XH-16—a twin-engined military helicopter which is probably the nearest approach to the B.E.A. specification now being studied by the British aircraft industry. Subject to availability of suitable aircraft, B.E.A. eventually plan to open up a comprehensive network of inter-city helicopter services within a range of 300 miles.

### MARATHONS FOR WEST AFRICA

FOUR 18-seat Handley Page Marathon feeder-liners have been ordered by the West African Airways Corporation for its 6,500-mile network of tropical routes in Nigeria, the Gold Coast and French West Africa. This is the second order for Marathons to have been announced within the past three weeks; as reported in *Flight* of March 28th, three Marathons have been ordered by Union of Burma Airways for delivery later this year. The aircraft specified in both orders will have increased fuel tankage to give a total capacity of 410 gallons and a range of 1,400 miles.

The West African order follows a rigorous three-month trial of the first production Marathon with W.A.A.C. last year. During this period it flew 60,000 miles and logged 750,000 passenger-miles. Supplementing W.A.A.C.'s present fleet of 11 Doves (also Gipsy-Queen-powered), the Marathons will operate on some of the longest internal and inter-Colonial services.

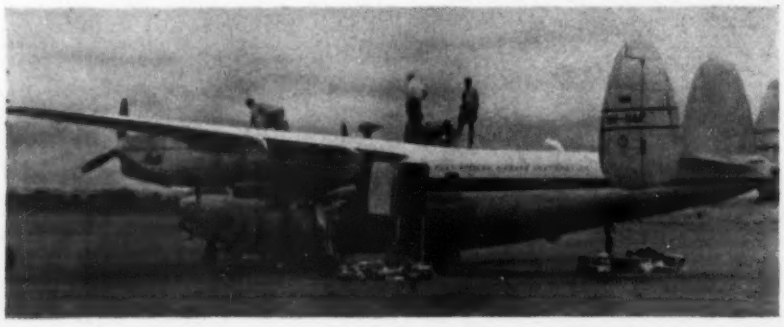
### T.W.A. REVENUE INCREASES

TRANS WORLD AIRLINES announce that they earned almost £3,040,000 profit during 1951—the equivalent of 25s per share and an 8.7 per cent increase in net income over the 1950 total of £2,796,000 (23s per share). The company's 23.9 per cent increase in total operating revenue—from nearly £42,000,000 in 1950 to nearly £52,000,000 last year—was partly offset by an increase of over £2,434,000 in income taxes. Passenger-revenue increased by 29 per cent to make the greatest proportionate contribution to T.W.A.'s record return. The success of the airline's coast-to-coast tourist services helped to increase the total number of revenue-passengers to 2,233,000, and to transport this record number of travellers T.W.A. flew 1,894,724,000 passenger-miles.

A joint statement by Mr. Warren Lee Pearson and Mr. Ralph Damon, chairman and president, respectively, of the company, said that "sharply increasing overall costs due to the inflationary spiral in the closing months of 1951 somewhat reduced our net income for the year. Nevertheless, a combination of internal efficiencies, increased passenger-sales and higher load-factors gave us a lower cost per revenue ton-mile in spite of unusual expenses resulting from the flood losses at our main overhaul base at Kansas City in July."

During 1951 T.W.A. flew 27 per cent more ton-miles of mail than in 1950 but payments from the U.S. Government were down by £155,000, following the introduction of the new non-subsidy ton-mile rate of 3s 3d which became standard in 1951.

T.W.A. now has the world's largest fleet of Constellations, with 66 in service and the first of ten Super-Constellations due to be introduced this summer. Last year the company began a programme of DC-3 replacement with the delivery of its first 40-seat Martin 4-0-4s; forty are on order.



*IN GREEN AND GOLD: As reported above, four Handley Page (Reading) Marathons have been ordered by West African Airways; shown here is the first production Marathon, which flew 60,000 miles in West Africa last year during a three-month trial on scheduled services of W.A.A.C.*

*VETERAN: One of the fleet of ex-T.W.A. Boeing Stratoliners operated by Aigle Azur is seen disembarking passengers from Tunis at Nice Airport. The company uses these machines on its routes between France and French Indo-China, Senegal, French Ivory Coast and French Equatorial Africa. One of the most advanced pre-war airliners, the Stratoliner bore the same relationship to the B-17 as the Stratocruiser does to the B-50 of to-day.*

## B.I.A.T.A. APPOINTMENT

ANNOUNCING the appointment of Mr. Phillip Bremridge, A.F.C., as its director, the British Independent Air Transport Association states that this new office has been created as part of B.I.A.T.A.'s policy of strengthening its negotiating power with Government departments and other official bodies.

For the past six-and-a-half years, Mr. Bremridge has served in the Conservative Research Department; during this period he has been acting as secretary to a number of Conservative Parliamentary Committees, including those of Defence, Air, Navy and Civil Aviation. Throughout the last war he served in R.A.F. Training Command, first as a flying instructor and later as commander of the Flying Training Research Squadron at the Empire Central Flying School.

## S.A.S. PLANS

THE president of Scandinavian Airlines System, Per A. Norlin, disclosed recently that his company has made no definite plans for replacing its twenty-one DC-3s. In an interview with our contemporary *American Aviation*, he said that modern twin-engined aircraft now being built in the U.S.A. were too large for most Scandinavian airports and that Scandias—which S.A.S. had found to be the best DC-3 replacements for Scandinavia—were unlikely to be delivered in further quantities, as the Saab factory was overloaded with military orders. Despite what had been said of the DC-3, S.A.S. felt that it would be used for a considerable time in many parts of the world.

Asked if B.E.A.'s Viscounts were likely to offer stiff competition to S.A.S. on any of its routes, Mr. Norlin said that, although he did not know whether or not such competition would be offered, his company had a very high regard for the Viscount but hoped to meet the challenge with DC-6Bs. The company did not expect to face the turbojet or turboprop problem until 1958-60, and felt that it could not jump from one aircraft type to another at too-short intervals, particularly with the present cost of modern aircraft and power-plants.

Mr. Norlin did not think that S.A.S. was likely to modify its DC-6B order to include DC-7s. From a preliminary examination of the DC-7, he thought it more suitable for trans-continental U.S. routes than for high-density traffic over the Atlantic. Concerning the possibility of fitting DC-6s and DC-6Bs with Wright compound engines, the S.A.S. president was equally conservative: he believed that the cost involved in conversion would not be justified, particularly in view of forthcoming turbojet and turboprop developments. The airline could not stand the high cost of "de-bugging" new aircraft.

The question of helicopters was being studied with great interest by S.A.S., who expected five years to elapse before a satisfactory and economical helicopter became available.

# BREVITIES

RADAR in the Channel Islands Zone is the subject of *M.C.A. Information Circular No.* 27/1952. The equipment concerned is a Marconi ACR (operating on a wave-length of 3 cm) which went into service on a trials basis on April 1st.

* * *

Trans World Airlines have appointed Ethiopian Air Lines as their general agents in Kenya, Tanganyika, Uganda and Zanzibar.

* * *

Trans-Australia Airlines have provided aircraft and crews for a new flying-doctor base at Charters Towers, Queensland. The company provide similar services at Charleville and Cloncurry.

* * *

International Aeradio, Ltd., have installed in Burma on behalf of the Burmese Government a twelfth prefabricated radio station; the new station is at Bhano airstrip.

* * *

Following the recent winding-up of Ali Flotte Riunite, Sabena has established its own commercial organization in Italy, effective from April 1st. The new office will be situated at 31, via Manzoni, Milan, and will be managed by Mr. Nicholas Kochnitzky.

* * *

Linea Aeropostal Venezolana has awarded Lockheed Aircraft Service-International a contract for major overhaul of its two Model 049 Constellations, to be undertaken at the L.A.S-I. base at New York. The first aircraft is scheduled to enter service early in August and the second in mid-October.

* * *

Two new appointments have been made to the European traffic and sales organization of T.C.A. Mr. John Wotton, formerly cargo manager for Britain and Ireland, becomes sales manager for the U.K. and Mr. A. Patten-Wilson, the airline's agency manager, has been appointed area representative. New appointments have also been made in T.C.A.'s operations organization. The former station manager at Goose Bay, Mr. R. Lockhart, has taken up a similar appointment at Prestwick, and Mr. John Horan, passenger agent at Shannon, has become station manager at the latter airport.

* * *

Prestwick Airport, which was visited by 75,000 members of the public during 1951, hopes to attract even more visitors to its public enclosure during the next seven months. Many of the airport buildings will be floodlit and approach roads will be decorated with international flags.

* * *

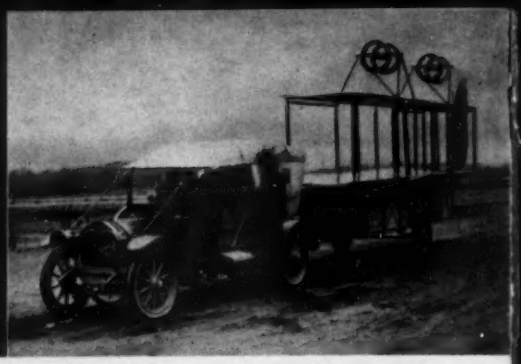
On May 1st T.C.A. will introduce a new tourist service from London to Toronto, using 40-seat North Stars. The return fare on this new service, which is intended to encourage travel to the Canadian International Trade Fair (to be held in Toronto from June 2nd to 13th), will be £186 9s.; single fare will be £103 12s. Tourist services will also be flown from Prestwick and Shannon.

* * *

In a recent announcement concerning the taking-over of Skyways, Ltd., by Lancashire Aircraft Corporation, Ltd., the omission of a line wrongly associated Sir Wavell Wakefield with the work of the contract manager. Mr. J. Eric Rylands is managing director and Sir Wavell Wakefield director, while A. Cdre. Sydney Smith is the senior executive and contract manager. Of the company's large and varied fleet, 15 of 24 Yorks are operational and the number is increasing. Their Haltons, Rapides and Consuls are also in service, in addition to a number of lighter aircraft.

* * *

Two Rapides, G-AKMD and G-ALGN, were recently ferried to Air Madagascar (who will use them on internal services) *via* West Africa and the Belgian Congo. The suppliers, Aerocontacts, Ltd., decided on this 9,000-mile route because the first aircraft became ready for delivery during the recent unrest in Egypt. The pilots, Capt. Parker and Capt. Palmer, reported that both flights were completed without mishap, despite lack of radio and extremely bad weather. Extra tanks were fitted to give a 500-mile range. A third Rapide (G-ALZH) ordered by Air Madagascar is now being delivered, again by Capt. Parker.



*THE MARCH OF PROGRESS: In sending us the photograph on the left, W. S. Shackleton, Ltd., remark that this is probably the first time that a one-piece-wing aircraft (actually a Miles Messenger, G-AKAI, destined for the Royal Queensland Aero Club) has been successfully loaded on a single short trailer. Whilst allowing their claim, we cannot resist adding the pictorial comment, discovered during an exploration of "Flight's" archives. . . .*

# FROM THE CLUBS

THE Wiltshire Flying Club's total flying time for the month of March amounted to 123 hr 30 min, bringing the total since January 1st to 270 hr 40 min. Night flying on Tiger Moths started again after a lapse of nearly six weeks due to poor weather conditions. Three of the W.F.C. fleet of four Tigers are fitted with night-flying equipment—as is their Autocar—and night-flying rates are £4 5s an hour dual and £3 10s solo on either type.

Wiltshire's instructional staff has recently undergone several changes, F/L. Hawkins having left to join a Reserve School and Mr. Bradford—now serving with the R.A.F. again—going to Salisbury, Rhodesia, as an instructor in the Empire Flying Training Scheme. Their places have been taken by Mr. F. G. Wade-Palmer, as C.F.I., with Mr. J. Heaton as his assistant. The services of F/L Jennings and F/L Bowry are available at weekends.

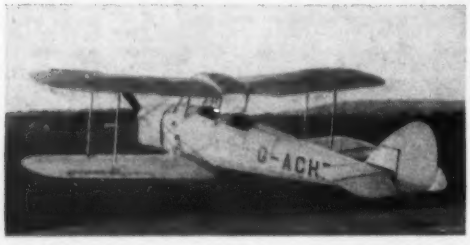
The "new aircraft for old" scheme introduced last April has been extended to include Tiger Moths and Auster Autocrats. In addition, a similar system is now in operation whereby the Wiltshire School of Flying, Ltd., will replace a weary Cirrus Minor II engine with a completely overhauled one "whilst you wait": a machine flown into Thruxton on the morning of an agreed date can be dealt with and flown away the same evening. An arrangement is also in force whereby the aircraft can be hangared free of charge whilst the old engine is overhauled and refitted.

The Thruxton Dingbat, mention of which was made in *Flight* last year, is now reported to be progressing slowly but satisfactorily under the watchful eye of Mr. J. Currie, the chief engineer. Obtaining a suitable undercarriage is proving something of a problem; a Magister or B.A. Swallow landing-gear might provide the ideal answer.

AT a committee meeting of the Vintage Aeroplane Club, held on March 30th, final arrangements were made for the club's next rally at White Waltham. One major change in plans—necessitated by considerations of insurance—is that the general public will not now be admitted by payment of an entrance fee; but associate members can be enrolled at the gate.

The V.A.C. is hoping for a large number of entries for the West London Trophy Race (mention of which was made in *Flight* of March 21st) and would-be competitors are reminded that the usual formalities must be complied with as regards competitors' tickets, third-party insurance, etc.

Taking the same form as the last rally, the event will begin on the morning of May 3rd, during which day the race will be flown and a programme similar to that staged at Denham will take place. The following day will be set aside, as before, to allow members to get airborne in one another's machines. Should the weather prove unco-operative the competitive programme—so far as possible—will take place on Sunday.




*The Vintage Aeroplane Club's Avro Cadet, referred to above.*

On completion of its C. of A. the Avro Cadet G-ACHP will become the first "official" V.A.C. aircraft and will be available throughout the rally for suitably qualified members who wish to fly in the various competitions which are being organized.

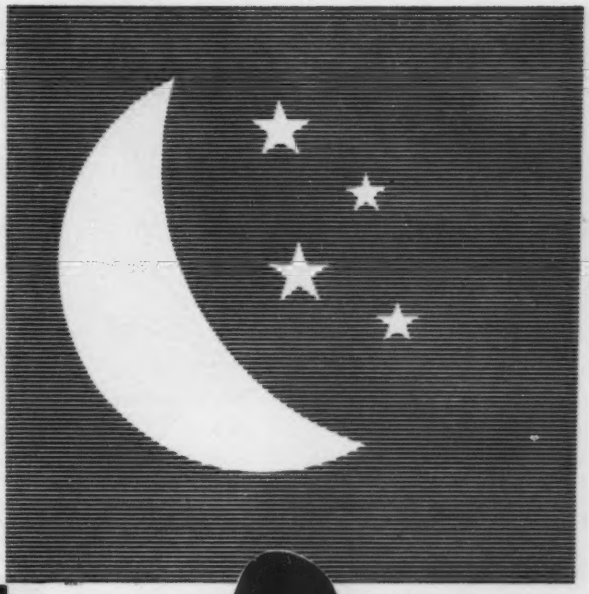
FURTHER particulars are now available concerning the Ragosine-Auster Homing Trophy Competition which will be held at Rearsby Aerodrome on Sunday, May 25th. The event will, as usual, take the form of a cross-country navigation and observation exercise, and, since it is in the form of a flying test, no competition licence is necessary. Competing pilots and their passengers are invited to fly in to Rearsby on the Saturday, and attend the Ragosine-Auster dinner-dance in Leicester that evening.

Through the generosity of members of the industry, an impressive prize list has been drawn up; in addition to the Ragosine-Auster Homing Trophy itself, for which all Auster pilots are eligible, the Cirrus Trophy is offered to competitors flying Cirrus-engined aircraft, while there will be prizes for women competitors and for novices. The number of entries will be limited, so intending competitors should apply without delay to the Competition Secretary, Auster Flying Club, Ltd., Rearsby Aerodrome, Leicester.

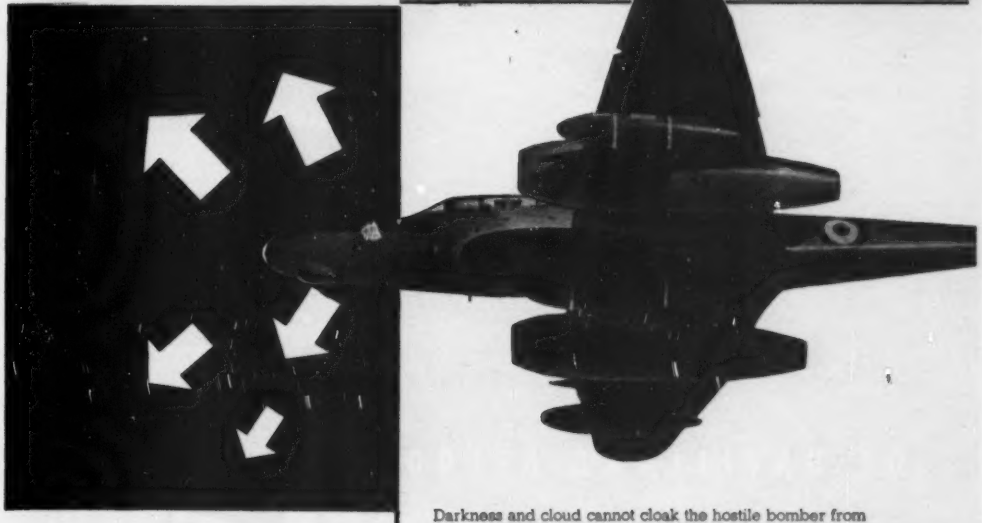
SHELL AND B.P. AVIATION SERVICE, who periodically bring out useful booklets and navigational aids for private pilots, have now issued a "supplementary flying log" designed to avoid jotting flying times down on scraps of paper. The idea was conceived following a suggestion made by a flying school which expressed the need for a card on which pilots could enter rough details of flights prior to final insertion in log-books. Providing six columns for date, aircraft type and registration, flight details and flying times, the cards are obtainable, free of charge, from Shell Mex and B.P., Aviation Department, Shell Mex House, Strand, London, W.C.2.

## FORTHCOMING EVENTS

Apr. 15. R.Ae.C.: Film Show.
Apr. 16. Aircraft Recognition Society: Annul General Meeting, Photographic Competition and Silver Rose Bowl Contest.
Apr. 21-24. S.A.E. Aeronautic Meeting, New York.
Apr. 22. R.Ae.S. Graduates' and Students' Section: "Servomechanisms," by F. H. Borlace, B.Sc. (Eng.), Grad.R.Ae.S.
Apr. 22-24. R.A.F. Golfing Society: Spring Meeting, Wilton Heath.
Apr. 24. R.Ae.S.: "Fuel Systems for Turbine-driven Aircraft," by J. E. Walker, A.F.R.Ae.S. (at Luton).
May 3. Vintage Aeroplane Club: Rally, White Waltham.
May 3-10. F.A.I.: Committee Meetings, Madrid.
May 5. I.A.T.A.: Fifth Annual Technical Conference, Copenhagen.
May 5-16. British Industries Fair.
May 10. Exeter Aero Club: Display.
May 10-11. l'Association des Amis de l'Aumoneries de l'Air: Rally.
May 17. Wolverhampton Aero Club: Display.
May 22. Aero-Club du Dauphine: Air Meeting, Grenoble.
May 22. Aero-Club de France: Coupe Scomm (helicopters).
May 24-25. Ragosine-Auster Trophy Navigation Competition, Rearsby.
May 29. R.Ae.S.: Fortieth Wilbur Wright Memorial Lecture: "Prophecy and Achievement in Aeronautics," by Sir Harry M. Garner, C.B., M.A., F.R.Ae.S.
May 30-June 2. Model-flying team contest, Belgium v. Great Britain, Namur.
May 31. Swansea and District Flying Club: Welsh Air Derby, Fairwood Common.
May 31-June 2. Aéro-Club de Cannes: International Rally.



N.F.11
...its radar
turns night
into day



Darkness and cloud cannot cloak the hostile bomber from detection and ruthless pursuit by the N.F.11 Night Fighter. Guided by complex, quick-ranging radar, the N.F.11 is fast, manoeuvrable, has a terrific rate of climb and is heavily armed with four 20 mm. wing-mounted cannon. Deliveries to the R.A.F. are being made against production orders which have been placed with Armstrong Whitworth Aircraft; and this deadly night fighter now takes on a major responsibility in the defence of Western Europe.

ARMSTRONG WHITWORTH
N.F.11

SIR W. G. ARMSTRONG WHITWORTH AIRCRAFT LTD.
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MEMBER OF THE HAWKER SIDDELEY GROUP
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# CORRESPONDENCE

*The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.*

### "Angels One Five"

THE two "stills" from *Angels One Five*, published in *Flight* of March 21st, do not encourage me to see the film. One can, of course, understand why Hurricanes of obviously later date have had to be used, as no actual Battle of Britain aircraft are airworthy; but why use roundels and camouflage which were not introduced until mid-1942? Had the correct camouflage and roundels been used, only the real expert could have spotted the extra 4in total length of the aircraft.

The correct camouflage for 1940 was as follows: Camouflaged top surfaces were "dark earth" and "dark green," under-surfaces were "duck-egg green" ("skys"). Roundels were: *wings*—top surface, red centre with blue outer ring; under surfaces, red centre, surrounded by white and blue, the white and blue bands being equal in width to the diameter of the red centre. *Fuselage*—the roundels on the fuselage were the same as under the wings with an additional yellow ring outside the blue and of the same width as the blue. This scheme, except for a minor modification, was in use until nearly two years after the Battle of Britain, when the roundel was modified to make it less conspicuous. At the same time as the modification of the roundel in mid-1942 the colour, also, was modified; "ocean grey" replaced "dark earth" and "sea grey medium" replaced "duck-egg green." This change accentuated the contrast of the camouflage pattern and completely changed the appearance of the aircraft.

The 1940 fin-flash was three vertical red white and blue stripes of equal width (about one foot each) covering the whole of the fin. In 1941 the flash was reduced to a rectangle of 24in by 27in high, the stripes being 8in broad. In 1942, at the time of the revised roundel, the fin-flash had the white stripe reduced in width and the red and blue widened correspondingly.

It will thus be seen that the flash on the fin of US, B conforms to no scheme. The squadron letters in the film are of the very much smaller type introduced with the new 1942 scheme.

There is no consistency anywhere, as correct 1942 camouflage should have the broad white tail band and yellow leading edge.

It is surprising how many well-informed people are unaware that there have been at least 12 major modifications to the colour and markings of fighter aircraft alone since the introduction of roundels in December, 1914, and that because of these modifications it is possible to date an aircraft without more information.

It is a common sight to see an aircraft still in service with an obsolete colour scheme; but if the Hurricanes depicted are supposed to be those used in the Battle of Britain, then they are appearing with roundels not even contemplated at the time.

Radlett, Herts. C. RUPERT MOORE.

[Our correspondent encloses a page of his own colour-drawings from *Camouflage*, 1939-42, by Owen G. Thetford, published by the Harborough Publishing Co.—ED.]

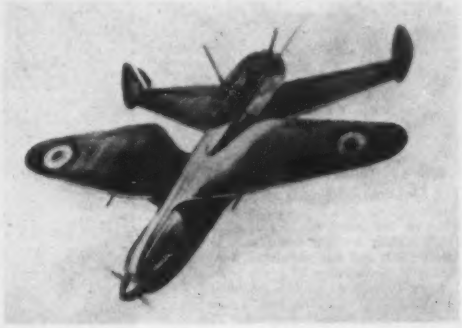
### The Delanne Fighter

THE letter, published in your February 15th issue, from Mr H. J. Penrose is very interesting, and the drawing of the Gremlin shows it to be of very similar configuration to the "duo-monoplane" designs of M. Maurice Henri Delanne. M. Delanne, as long ago as the late twenties, began to look for some method of improving aircraft design and eventually began a research programme based upon a tandem-wing layout. His resources being limited, this was a lengthy process, but in 1936 he discovered a very simple formula, governing the relationship between the two wings, that gave maximum performance. This performance was very impressive, the airflow of the front wing acting to increase the efficiency of the rear to give a combined lift of 35 per cent more than for a rectangular wing of the same area, and a speed ratio of 7 : 1 in wind-tunnel tests, with reduced fuselage drag.

The French Air Ministry on the basis of these results, awarded a contract for a two-seat fighter which was built and was similar to the Lysander modification with a similar rear turret with excellent field of fire. It is said that the specification insisted upon a gull form for the front design although he did not agree with it; this may be true, since Potez and Dewoitine produced gull-wing fighters about the same time. Despite this the machine did 360 m.p.h., with 50 m.p.h. for landing, on only 860 h.p. A 4th scale model of this machine, powered by 180 h.p. landed at 37.5 m.p.h., for a top speed of 195 m.p.h.

The machine was particularly interesting as it had a normal tractor engine, with the pilot in the rear fuselage between the wings—which might give a balance to the Gremlin design.

The Germans were very interested in these aircraft but Delanne managed to fake his formulae and destroy his prototypes, and



*The Delanne fighter—a drawing from "Flight" of February 17th, 1938*

although one German technician said his ideas were perhaps the most useful things France had to offer, he was left in prison until the high landing speeds of conventional jet fighters caused the Germans to consider his ideas again in attempts to design a fast aircraft capable of operating from small fields. Delanne would not tell his secret, despite "persuasion," and when liberated, he went to America to recover, his old organization having been destroyed. He is now designing once more, and several U.S. firms are said to be interested. A pilot, he realizes that conventional aircraft are difficult to fly, and ease of control was one of his basic parameters. How well he succeeded can be seen from the fact that his aircraft are completely stall-proof in the accepted sense, the large rear wing retaining lift and control and the end-plate fins increasing its efficiency; the aircraft merely sinks in the tail-down attitude and can in fact be landed power-off in this manner, with a sinking speed of only about 17ft sec.

I do not know whether Westlands discovered the same relationship as Delanne; if they did, the performance of the Gremlin should have been ideal, and the ease of handling especially important to the average private-owner pilot, who does not put in enough hours to learn to deal with an even slightly tricky design.

Cambridge. PEDANTICA.

### Airport Landing-rates

IN his R.Ae.S. lecture on Terminal Air-traffic Control, reported in *Flight* of March 28th, G/C. Whiteley is of the opinion that the landing rate of aircraft can be increased to "120 an hour or more." This is all right on paper, but it will not work in practice; 12 an hour with radar sequencing is still pretty good, and the controller has to be on his toes to achieve even this.

Does G/C. Whiteley realize the strain on present-day controllers as it is? Does he know what it feels like to do seven very concentrated hours in a G.C.A. truck, working almost flat out all the time, and in the dark (watching a radar tube) at that?

No! A two-minute rate is, in my opinion, all we can hope for for many years to come—and even then you can't have many take-offs in between.

Ruislip, Middlesex. D. COOPER.

### "Naval Test-flying"

CONGRATULATIONS are due to Lt.-Cdr. E. M. Brown on his very clear yet modest description of naval test-flying at Farnborough, included in the March 28th issue of *Flight*.

However, I must hasten to point out an error that appeared in the introduction to the author, which I am sure he would be first to correct were he not at present on the far side of the Atlantic.

Although Farnborough has boasted a Chief Test Pilot for many years, the mutual appointment of "Chief Naval Test Pilot at the Royal Aircraft Establishment," does not now exist and has never existed. As a member of the "Silent Service," I feel sure Lt.-Cdr. Brown would be horrified at such elevation.

R.A.E., Farnborough. THOMAS G. INNES.

[The appointment struck us, also, as unfamiliar; but we did not question it, for the introduction in which it was mentioned was issued in printed form by the Admiralty, who used the words "... the position of Chief Naval Test Pilot at the Royal Aircraft Establishment."—Ed.]

# SERVICE AVIATION

*Royal Air Force and Naval Aviation News*

## Lord Trenchard in Canada

IN Montreal on Friday next, Marshal of the Royal Air Force Lord Trenchard is to be the guest of honour at a dinner given jointly by the Air Force Veterans' Association and the Montreal Wing of the R.C.A.F. Association.

Lord Trenchard has been associated with the Canadian Services for over half a century. He served with the Canadian Scouts in the South African war.

## Korean Awards

THE following awards have been made for service with the United Nations forces in Korea; the period covered is July 1st to December 31st, 1951. Extracts from the citations are as follows :—

DISTINGUISHED FLYING CROSS

*S/L. J. M. Helme, A.F.C., R.A.F.*, who has commanded the first R.A.F. squadron to participate in the Korean campaign and which, since July, 1950, has carried out numerous operational sorties. S/L. Helme has personally flown 30 operational sorties involving 380 flying hours, many of these flights being carried out in extremely difficult weather conditions, particularly during the winter months. He has invariably flown himself on the more hazardous sorties, on which he has set a fine example of leadership, and has done more than his share of operational flying over Korean waters.

*F/L. T. A. Bridge, R.A.F.*—This officer has captained his aircraft on thirty-six operational sorties, involving 350 flying hours. These operations have frequently been carried out in extremely bad weather conditions.

*Capt. L. R. B. Addington, R.A.*—This Army officer volunteered to extend his overseas tour in order to accompany an A.O.P. flight to Korea. At all times his handling of difficult situations, and his ability to train divisional artillery on enemy infantry and gun positions were outstanding. During "Operation Commando" he sighted an active hostile gun position of eight guns which was causing considerable trouble to our forward troops but which was out of range of our own guns. An air strike was arranged, but the fighters were unable to locate the target as the guns were so well camouflaged. Capt. Addington therefore flew some 8,000 yards into enemy territory over the target in an effort to indicate the guns to the Mosquito directing the fighters. The Mosquito was unable to contact him, but he remained over the target despite the fact that his petrol was getting low. Eventually, when his petrol supply was almost exhausted, the Mosquito managed to locate him, whereupon he dived low over the target and fired Verey lights on to the guns to assist the aircraft. The determination he displayed on this occasion was instrumental in the damage or destruction of eight enemy guns. This one instance was typical of the valuable service rendered by Capt. Addington throughout his tour of duty.

*F/L. C. D. Murphy, R.A.A.F.*—No fewer than 100 operational missions in Mustang and Meteor aircraft have been flown by F/L. Murphy in support of the United States Forces in Korea. As acting deputy commander he has led his squadron with vigour and initiative and his personal example has been an inspiration to other pilots of the squadron. In ground attack missions, in adverse weather conditions, this officer has pressed home attacks to low level and his leadership of fighter formations has been of sound judgment and determination in keeping with the highest traditions of the Royal Australian Air Force.

*F/L. R. L. Dawson, R.A.A.F.*, has flown a total of ninety missions in Mustang and Meteor aircraft in support of the United Nations Forces in Korea. This officer's aggressiveness was most noticeable in an engagement with enemy aircraft on September 26th, 1951.

*W/O. R. C. A. Hunt.*—Another Australian fighter pilot who has flown a total of 115 operational missions in Mustang and Meteor aircraft, in support of the United Nations Forces in Korea. This warrant officer volunteered for and completed a second operational tour with his squadron.

*(Other awards will appear next week)*

*"HE WHO IS ABOVE": Air Marshal J. D. I. Hardman, C.A.S. of the R.A.A.F., presenting a replica of the Hawk of Horus crest of the R.A.F. Staff College to G/C. A. Earle, commandant of the R.A.A.F. Staff College at Point Cook. In Egyptian mythology the Hawk of Horus is "He who is above" and represents the power of light, fighting—always victoriously—against Set, an earthbound animal representing the power of darkness.*

## R.A.F. and R.A.A.F. Exchange

UNDER the exchange of officers scheme, S/L. W. M. Dixon, D.S.O., D.F.C., R.A.F., is to command an Australian Lincoln squadron at Amberley and S/L. R. H. Hosking, D.F.C., A.F.C., R.A.A.F., is to take over a P.R. Canberra squadron of the R.A.F. S/L. Hosking is at present a student at the R.A.F. Flying College, Manby, Lincolnshire.

*WINNING CAPTAIN : Marshal of the Royal Air Force Sir John Slessor, C.A.S., hands the Harewood Trophy into the keeping of Cdt. Sgt. J. N. Barnden, captain of the 61 Group team, winners of the trophy with 37 points.*

## R.A.F. S.A.A. Championships

THE annual championship meeting of the R.A.F. Small Arms Association will be held at Bisley from June 7th to June 13th, both dates inclusive. Shooting by Commands for the finals of the Rothermere Shield will take place on the last day of the meeting.

## No. 612 Still at Edzell

IT is thought that work on the runways at Dyce, which should have been completed this month, will not now be completed until late summer. This means that No. 612 (County of Aberdeen) Squadron, R.Aux.A.F., will still operate from Edzell, even after returning from Malta, where the summer camp is to be held.

The attraction of a visit to Malta should help in the recruiting drive which the commanding officer, S/L. G. W. Cory, A.F.C., has instituted. In this connection a flight of Vampires from the squadron flew over Aberdeen at precisely 11 a.m. each day last week and an air display was held at Dyce on the Saturday. Despite the handicap of the runways being under repair, the programme included aerobatics by Meteors and Vampires and fly-pasts by a Shackleton and a Hastings.

## R.A.F. Benevolent Fund

THE controller of the Benevolent Fund, A. V-M. Sir John Cordingley, has announced that expenditure on all forms of assistance during 1951 totalled £640,466, an increase over the previous year's figures of £31,650. Expenditure exceeded income, including donations, subscriptions, Service contributions and bequests, by £199,239.

In England 18,842 cases were assisted, at a cost of £512,268; Scottish cases, of which there were 1,798, accounted for £23,470; expenditure on 1,192 cases in Wales amounted to £27,389; and Northern Ireland and the Republic of Ireland together produced 1,635 cases, who shared £15,378.

Notable contributions to the Fund during the year included £26,453 raised by Mr. Churchill's broadcast appeal on Battle of Britain Sunday.

"Flight" photographs

*Air Chief Marshal Sir Hugh P. Lloyd, A.O.C.-in-C., Bomber Command, and A. V-M. T. N. McEvoy concentrate on what is happening in the ring, whilst Air Marshal Sir Basil Embry, A.O.C.-in-C., Fighter Command, and his son have had their attention momentarily distracted by something else. (Right) Cdt. J. C. Cowan, winner of the "Flight" Cup, receives his trophy from the Technical Editor.*

# A.T.C. BOXING CHAMPIONSHIPS

IT is simply unfortunate that the number of bouts nowadays making up the Air Training Corps Boxing Championship finals should be too many to squeeze into one evening, with the consequence that some of the fights have to be held during the afternoon in another place. This year, no fewer than seven of the bouts—including that for the *Flight* Cup—were held during the afternoon of Monday, March 31st preceding the evening events, and were fought at R.A.F. Station Uxbridge. Nevertheless, this pressure is a significant symptom of the healthy state of the Corps and, as the Chief of the Air Staff said at the conclusion of the evening, the A.T.C. deserve the greatest credit for laying on the exercise on such a grand scale; the championships were evidence of that spirit needed in the R.A.F. or, indeed, in any fighting service, namely, the inability to know when one was beaten.

Although one or two youngsters manifestly did know when they had had enough, in no case was there the slightest sign that the losing contestant was suffering a lack of heart. Almost all the fighters were well-matched and if, in most cases, the winner was he who showed the more active aggressiveness, the level of fighting science said a great deal for the quality of the coaching which the cadets receive. To reach the championship—between Northern and Southern areas—each had fought through Unit, Wing, Group, Inter-Group and Area eliminations.

Among the better bouts of the evening that between Cdt. D. Young and Cdt. W. G. Brown was the second in Class A; Brown's better boxing, coolness and consistent attack gave him the verdict and the Lord Balfour Cup for the best performance in Class A; in addition Young was finally adjudged the best loser in the championship, and so received the Roy Limbert Cup from the C.A.S., Sir John Slessor. Another excellent fight in Class A was that at 9 st 7 lb between Cdt. M. Monaghan and Cdt. A. J. A. Perkins. Perkins had the advantage of height and reach, but Monaghan's strength and his attack in the third and final round prevailed.

The only knock-out during the evening was administered to Cdt. J. Hanlon by Cdt. A. Cogger, although there was not much doubt that Hanlon was the better boxer, and the right cross which laid him low must be deemed to have been something of a lucky punch. In the following fight, Cdt. H. A. McCrorey gained the verdict on a foul by Cdt. R. W. Brown in the second round; these two went at it with great vigour, if little science, and there could be little question that the blow which ended the contest was an unfortunate chance strike. Cdt. T. Green at 10 st 7 lb in Class B had so much the better of Cdt. D. Howe that he floored him twice during the first round, the referee then stopping the fight.

In the first fight in Class C, Cdt. A Patton was always on the attack and a good deal more warlike than his opponent, Cdt. J. Newcombe. The best of the fights was undoubtedly that in which Cdt. J. N. Barnden won a hard-fought victory over Cdt. I. Orr. Orr was perhaps the stronger, and tended to use weight rather than science, but Barnden hit consistently straight and was much the cooler and better punching fighter. His consistent attack, indeed, gained for him the A. J. Elvin Cup for the best performance in Classes B and C.

Again this year the Harewood Trophy—awarded to the Group gaining the greatest number of points in the finals—was won by 61 Group (London and Eastern) with 37 points and, as captain of the team, Cdt. Barnden had the reward of receiving the Trophy from Sir John Slessor. 63 Group (Wales) were runners-up with 26 points.

| Bout | Name of Winner | Squadron | Name of Opponent | Squadron | Trophy |
|---|---|---|---|---|---|
| CLASS A (AGE 15-16 YRS) st lb | | | | | |
| *7 0 | Cdt. J. Charles | 2237 (Thornley Park Sch.) N. | Cdt. R. A. Green | 1147 (Barking) S. | |
| 7 7 | Cdt. H. Hayes | 1701 (Johnstone) N. | Cdt. R. Batts | 2208 (Eynsham) N. | |
| 8 0 | Cdt. W. G. Brown | 372 (Barry) S. | Cdt. D. Young | 1300 (Nottingham) N. | |
| 8 7 | Cdt. J. Snooks | 1184 (Mountain Ash) S. | Cdt. A. Barry | 2258 (St. John's School) N. | |
| 9 0 | Cdt. R. A. Vodden | 16F (Wood Green) S. | Cdt. A. Meyrick | 1936 (S. Nottingham) N. | |
| 9 7 | Cdt. M. Monaghan | 59 (Huddersfield) N. | Cdt. A. J. A. Perkins | 2219 (Tenby) S. | |
| 10 0 | Cdt. S. A. Bloxham | 16F (Wood Green) S. | Cdt. J. Cunningham | 59 (Huddersfield( N. | |
| CLASS B (AGE 16-17 YRS) | | | | | |
| *7 0 | Cdt. A. R. Parsons | 2239 (Kineton) N. | Walk-over | | The Renton Cup |
| *7 7 | Cdt. B. Welch | 2239 (Kineton) N. | Cdt. R. A. W. Rule | 1159 (Edmonton) S. | The Sir Bertram Jones Cup |
| 8 0 | Cdt. A. Cogger | 2048 (Dagenham) S. | Cdt. J. Hanlon | 178 (Fylde Farm Sch.) N. | The Aeroplane Cup |
| 8 7 | Cdt. H. A. McCrorey | 1701 (Johnstone) N. | Cdt. R. W. Brown | 372 (Barry) S. | Sir Simon Marks Cup |
| 9 0 | Cdt. G. Fulcher | 1000 (Bedlington) N. | Cdt. E. J. D. Thompson | 39F (Barnes) S. | Aeronautics Cup |
| *9 7 | Cdt. A. Curnock | 187 (Worcester) N. | Cdt. E. Evans | 153 (Slough) S. | Eland Cup |
| 10 0 | Cdt. D. Gingell | 2157 (Mitcham) S. | Cdt. J. Farrell | 178 (Fylde Farm Sch.) N. | Sir Adrian Chamier Cup |
| 10 7 | Cdt. T. Green | 766 (Tennison G.S.) S. | Cdt. D. Howe | 178 (Fylde Farm Sch.) N. | Bailey Cup |
| 11 0 | Cdt. W. J. Gratton | 16F (Wood Green) S. | Cdt. G. H. Watters | 498 (Wishaw) N. | Londonderry Cup |
| CLASS C (AGE 17-18 YRS) | | | | | |
| 8 0 | Cdt. A. Patton | 2256 (White Abbey) N. | Cdt. J. Newcombe | 43F (Merton) S. | Lawley Cup |
| *8 7 | Cdt. M. Inwood | 1223 (Caerphilly) S. | Cdt. E. Battersby | 2200 (Oldham) N. | Lord Glendyne Cup |
| 9 0 | Cdt. P. M. Ellery | 212 (Islwyn) S. | Walk-over | | Duncan Smith Cup |
| 9 7 | Cdt. S. Thomas | 1223 (Caerphilly) S. | Cdt. H. Clarke | 178 (Fylde Farm Sch.) N. | Air Reserve Gazette Cup |
| 10 0 | Cdt. J. N. Barnden | 2158 (Boro' Green) S. | Cdt. I. Orr | 2256 (White Abbey) N. | Hilary Cup |
| 10 8 | Cdt. C. Moercroft | 178 (Fylde Farm Sch.) N. | Cdt. E. S. Phillips | 1223 (Caerphilly) S. | Arthur Mack Cup |
| 11 2 | Cdt. D. J. Salmsbury | 1148 (Penarth) S. | Cdt. E. Rowley | 1000 (Bedlington) N. | Sir Harry Price Cup |
| *11 11 | Cdt. J. C. Cowan | 327 (Kilmarnock) N. | Cdt. J. Stanley | 1582 (Ardsle) S. | *Flight* Cup |
| *12 10 | Cdt. P. Sharratt | 1582 (Ardsle) S. | Walk-over | | Robert Strauss Cup |

* These events took place during the afternoon at R.A.F. Station, Uxbridge.

# THE INDUSTRY

## A New Nimonic

FROM the outset of gas-turbine manufacture in this country, the nickel-chromium alloys developed under the name of Nimonic by the Mond Nickel Co., Ltd., have been the standard materials for the manufacture of the turbine rotor blades of every British aircraft gas-turbine in production. To maintain this remarkable record, the company now announces the development of Nimonic 95—an alloy generally similar to Nimonic 90, but with a higher percentage of hardening elements. The new material can still be hot-worked and machined, and, while exhibiting mechanical properties similar to those of Nimonic 90, can be employed at a temperature some 50 deg C higher. This means that Nimonic 95, at 800 deg C and under a stress of 19 tons sq in, will take 50 hr to reach tertiary creep and 75 hr to rupture, with a creep-rate in the secondary stage of less than 0.01; the same figures will apply under a stress of 12 tons sq in at about 920 deg C.

## Dollar Earners

THAT the products of Desoutter Bros, Ltd.—electric and pneumatic power tools—are, in the export field, one of the most efficient converters of steel into foreign currencies is remarked by their chairman, Mr. E. R. Desoutter, in the annual report circulated to shareholders: he points out that this conversion-rate represents over £6,000 per ton of steel.

The report states that the sales volume for the year under review increased by 17 per cent over that for the previous year, and that a very large proportion of the total output is being exported to more than fifty countries.

## Low-frequency Generating Plant

THE aircraft industry is finding numerous applications for a variable low-frequency generator supplying constant voltage. Recently, Electro Plant, Ltd., of Wembley, Middlesex, were asked by a leading aircraft manufacturer to design such a generator for supplying a 2 kW vibrator with a frequency varying between 0 and 50 c.p.s.

A normal d.c. machine is used, the windings being converted to triplex form to give the required voltage of approximately 110. Power is supplied by a single-phase, squirrel-cage motor, which also drives a generator supplying a busbar voltage of 200. This latter voltage, after regulation, supplies the field current for the main d.c. generator, a secondary d.c. machine, and a d.c. motor. This second motor is supplied with armature current from the secondary d.c. generator and is employed to drive the brush-gear of the main output generator at any speed between 0 and 1,500 r.p.m., the speed being controlled by the potentiometer regulating the secondary generator field current.

This rotation of the main brush-gear was expected to lead to trouble caused by variable centrifugal brush-loading; in the present apparatus, the brushes are held against the commutator by balance weights which have been found perfectly effective in practice.

The prototype rig, which we examined recently, works satisfactorily, giving very constant voltage throughout the range of frequencies.

## Northern Aluminium Appointments

IT is announced that Mr. Fraser W. Bruce has been appointed managing director of the Northern Aluminium Co., Ltd., in succession to Mr. Kenneth Hall, who has accepted an appointment in the head office of the Aluminium, Ltd., group of companies in Montreal.

Mr. Bruce, a Canadian who was well known in the British aluminium industry before the war, has for several years been vice-president and general sales manager of the Aluminum Company of Canada, Ltd., which he joined on graduating from the University of Toronto in 1927. He was in charge of the London office of Aluminium Union, Ltd., from 1936 to 1939.

Mr. Hall has been managing director of Northern Aluminium for the past five years. Under his direction, the construction and installation of the large continuous strip mill at Rogerstone, South Wales, was successfully undertaken and completed. He has been prominent in the light metals industry in Great Britain, having served as president of the Aluminium Development Association and as chairman of the Aluminium Industry Council.

Northern Aluminium also announce new appointments in their sales department. Mr. J. H. Mayes, manager of the development division since 1946, becomes castings and forgings sales manager, with an office at the Birmingham works; he is succeeded by Mr. H. M. Louch, from the London sales office. Hitherto part of the development division, publicity now becomes a separate division under Mr. E. D. Iliff, who has been publicity manager for the last seven of his seventeen years with the company.

## Lightweight Tachometer Generator

SIMILAR in principle to, and mechanically interchangeable with, the standard Mk VIII generator, a new lightweight engine-speed generator is being marketed by Smiths Aircraft Instruments, Ltd.

A circular-magnet rotor is used, mechanically locked to the drive shaft. Tappings are taken from the three-phase windings of the slotted stator and crimped to a four-pin ceramic plug-connector which has been specially designed for the generator and is both leak- and fire-proof.

*The compact lightweight tachometer generator.*

Drive is effected by a standard S.B.A.C. splined shaft and quill-drive and attachment is made by a mounting flange bolted directly to the engine. The generator is designed to operate effectively when immersed in oil; no oil seal is therefore fitted and the maximum operating ambient temperature has been placed at 125 deg C; this is 25 deg C higher than is permissible with the Mk VIII generator.

Only one engine-speed indicator can be driven from this generator, due to electrical limitations imposed by the small overall dimensions. The unit is not, therefore, intended to be a substitute for the company's heavier generators.

## Essex Aero and the M.A.C.

FOLLOWING the recent announcement of the setting-up of a body to be known as the Magnesium Advisory Committee the following statement has been made by Essex Aero, Ltd., Gravesend:—

"Essex Aero, Ltd., wish to make it quite clear that they were not in any way concerned in the recent formation of a Magnesium Advisory Committee stated to have been set up by the principal companies of the magnesium industry. As Ministry of Supply returns show, this company was responsible during the period January 1st, 1950, to December 31st, 1951, for an output of 1,439 tons of rolled sheet and strip magnesium of the total U.K. output of 1,487 tons, some of which has been exported to the U.S.A., added to which there is a large output of cast products from the company's foundry. The company therefore considers itself a major producer.

"Essex Aero, Ltd., were asked to participate in this enterprise, but felt bound in the interest of the industry as a whole to preserve their complete independence. In the use of the words 'the principal companies of the U.K. magnesium industry have formed a consultative and advisory committee to be known as the Magnesium Advisory Committee,' the statement is not strictly accurate. Similar remarks apply to the words 'It will also serve as the official liaison body for negotiations with Government departments on all matters concerning the industry.'

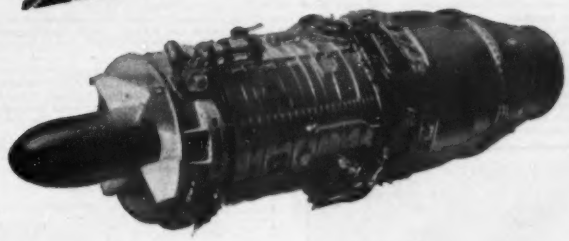
"As producers of approximately 97 per cent of the U.K. total output of rolled and strip magnesium, Essex Aero, Ltd., are bound to point this out."

Since the above statement was made, the following comment has been issued by the Magnesium Advisory Committee over the signature of the chairman, Mr. E. Player:—

"The formation of this representative committee has been welcomed by the Ministry of Supply as affording a useful means of consultation between the industry and the Ministry on matters of mutual interest in the magnesium field. It is not concerned with sale prices and in no sense affects the independence of individual members.

"Essex Aero, Ltd., refused an invitation to co-operate, as they were fully entitled to do. Their abstention is regretted and the invitation to join the new committee remains open to them at any time they care to accept it."

SAPPHIRE



THE ENGINE OF THE
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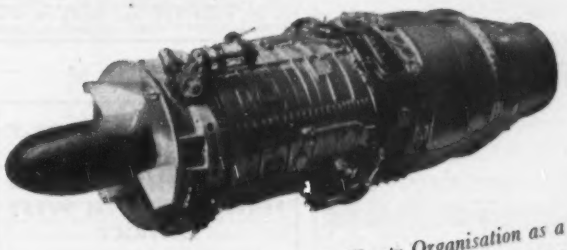
WRIGHT J/65



*Adopted by the two principal members of the North Atlantic Treaty Organisation as a standard power unit for military aircraft, the Armstrong Siddeley Sapphire high-thrust turbojet (its U.S.A. version is known as the Wright J/65) will play a major part in freedom's defence.*

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**The Publishers** retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

**Situations Vacant.** The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc. if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is exempted from the provisions of The Notification of Vacancies Order 1952.

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we realise with a feeling of great satisfaction that—with 1952 so young and all that—we have already delivered to clients this Leap Year, or have received confirmed orders so to deliver (as they say) 20 different types of aircraft. Some of these we are supplying in quite considerable numbers.

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**£350** Proctor III, 270 engine hours. 12 months C. of A. Fitted 6-channel VHF. Immaculate condition. Sell or exchange car, cash adjustment either way.—326 Linthorpe Road, Middlesbrough. Tel. 85426. [7958

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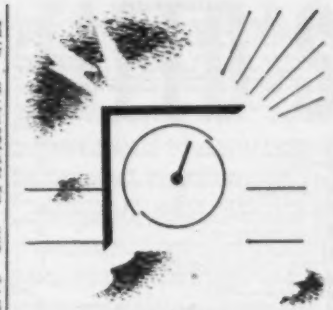
THE College of Aeronautics, Cranfield, invites applications for a Research Fellowship which has recently been established at the College by the English Electric Co., Ltd. The Fellowship is intended to provide opportunity for post-graduate research into problems of vibration stability and control of aircraft, and is tenable for one year beginning on or about October 1st, 1952. The value of the Fellowship is £500.—Applications, giving full particulars of education and experience and quoting the names of three referees, are required by May 1st, 1952, and should be addressed to: The Registrar, The College of Aeronautics, Cranfield, Bletchley, Bucks. [7830

### SITUATIONS VACANT

*The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.*

THE DE HAVILLAND AIRCRAFT CO., LTD., HAVE VACANCIES FOR SENIOR DESIGN AND INTERMEDIATE DRAUGHTSMEN PREFERABLY WITH AIRCRAFT EXPERIENCE IN THEIR HATFIELD AND LONDON (REGENT STREET) OFFICES. Applications, stating age, experience and salary required to CHIEF DRAUGHTSMAN, THE DE HAVILLAND AIRCRAFT CO., LTD., HATFIELD, HERTS. [0931



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Of course, we also have instruments connected with Radio Gear and the Electrical Instruments such as Voltmeters, Ammeters, etc., but, not surprisingly, these are dealt with by the Radio and Electrical Sections as appropriate. Shortly, we are expecting to publish lists of Instruments in the 6B/ and 6C/ ranges, and clients requiring priority for receipt of these lists should let us know immediately.

### SITUATIONS VACANT

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VICKERS-ARMSTRONGS, Ltd. (Aircraft Section) have vacancies at Hurn Depot for the following staff:
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APPLY in writing, to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, Surrey. Applications are subject to the approval of the Ministry of Labour and National Service. [7918

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STATES OF JERSEY AIRPORT

APPLICATIONS are invited for a vacancy for a meteorological forecaster. Candidates should have had considerable experience in forecasting and good qualifications in physics and mathematics.—Full details of meteorological experience, age, education, etc., should be given when applying for further details to the Airport Commandant, States of Jersey Airport, Jersey, C.I. [7880

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LOFTSMEN with previous experience of full-scale layout work or similar workshop practice.

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D. NAPIER AND SON, Ltd., The Airport, Luton, require:—

ONE senior technical assistant, for employment in the Flight Test Office, on development of aero engines and installations, preferably with associate fellowship or equivalent qualifications.

SOME knowledge of performance and theory of gas turbines desirable, and ability and willingness to fly, an advantage.

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APPLICANTS should apply to their nearest Employment Exchange. [7914

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APPLICATIONS, stating age, experience, salary required, etc., should be sent to the local Employment Exchange. [7941

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JIG and tool draughtsmen required by Percival Aircraft, Ltd., Luton Airport, Beds, fully experienced.—Applications, in writing, to Manager, Ministry of Labour and National Service, Luton, Beds. [6569

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GLOSTER AIRCRAFT Co., Ltd., require senior and junior weight engineers. Interesting work on new projects. Permanent positions offered to suitable applicants. —Applications in writing, stating age, experience, qualifications and salary required, must be made through an Employment Exchange or Scheduled Agency. [8013

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H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [8020

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D. NAPIER AND SON, Ltd., Luton Airport, require a senior technical assistant for flight development testing of experimental engines; academic standard preferably to degree in mechanical engineering, or Higher National Certificate together with some similar previous experience. Work on gas turbines and/or aero engine development would be a special advantage.

APPLY, giving fullest possible particulars of qualifications and previous experience, to Staff, together with salary expected, to local Employment Exchange. [7942

AIR SERVICE TRAINING, Ltd., require Category A flying instructors for fighter and twin conversion duties at Karachi. Experience on Harvard, Fury, Tempest and Dakota desirable. Salary approximately £2,000 per annum.—Application should be made to the Commandant, Air Service Training, Ltd., Hamble, Southampton, marking letters and envelopes P.I. [7927

THE GLOSTER AIRCRAFT Co. requires senior and intermediate stressmen to work on designs and projects of advanced interest. Excellent prospects of advancement for sound and energetic men.—Applications in writing, giving full particulars of technical qualifications, age, experience and salary required, to be made through an Employment Exchange or Scheduled Agency. [8011

APPLICATIONS are invited from senior and intermediate design draughtsmen. Experience of aero-engine design desirable, but not essential. Also checkers. —Please write, stating age and giving details of previous experience in chronological order to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [8009

SENIOR designer for aero-engine gas-turbine project design required in well-known firm in London area. Previous experience on mechanical design is essential. Good prospects of promotion for an energetic and enterprising candidate.—Please write, stating full details of age, experience, qualifications and salary required, quoting Ref. ACJ., to Box 7936.

AIR FORCE, Naval, civil and helicopter aircraft all under design and development at Percival Aircraft, Ltd., Luton Airport, Beds. Applications are invited from senior and junior draughtsmen, and stressmen for work on this interesting programme.—Write, stating details of experience and salary required, to Manager, Ministry of Labour and National Service, Luton, Beds. [8006

EXPERIENCED stressmen required by Percival Aircraft, Ltd., Luton Airport, Beds. for responsible position in stress office. Minimum requirements B.Sc. (or equivalent), several years' experience, ability to take charge of stressing of complete aircraft.—Applications, in writing, to Manager, Ministry of Labour and National Service, Luton, Beds, giving details of training, experience, age and salary required. [8008


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TECHNICAL assistant required for weight investigation of turbine design schemes. Some engine design and/or stress experience desirable. Good opportunity for young engineer with H.N.C. for broader experience.—Applicants should write, giving age and previous experience in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [7948

SENIOR technical assistant required for Engine Technical Office. Knowledge of engine stress calculations and mechanical testing including vibration analysis desirable. B.Sc. and/or A.M.I.Mech.E. preferred.—Please write, giving age, previous experience and qualifications, in chronological order, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [7947

APPLICATIONS are invited from design draughtsmen and stressmen, also technical assistants with combined design and performance experience for work on both reciprocating and gas turbine aero engines.—Applications should state full particulars of experience and qualifications and should be addressed to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [8002

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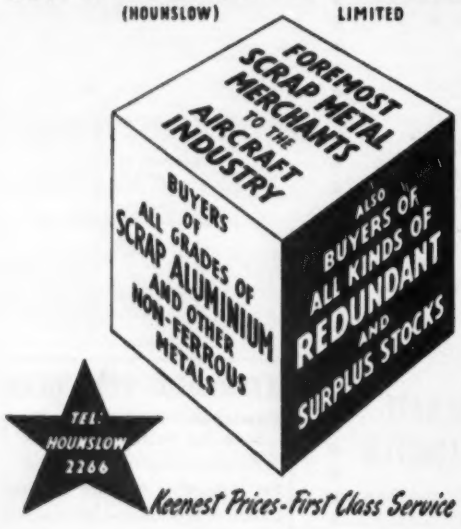
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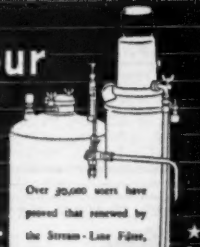

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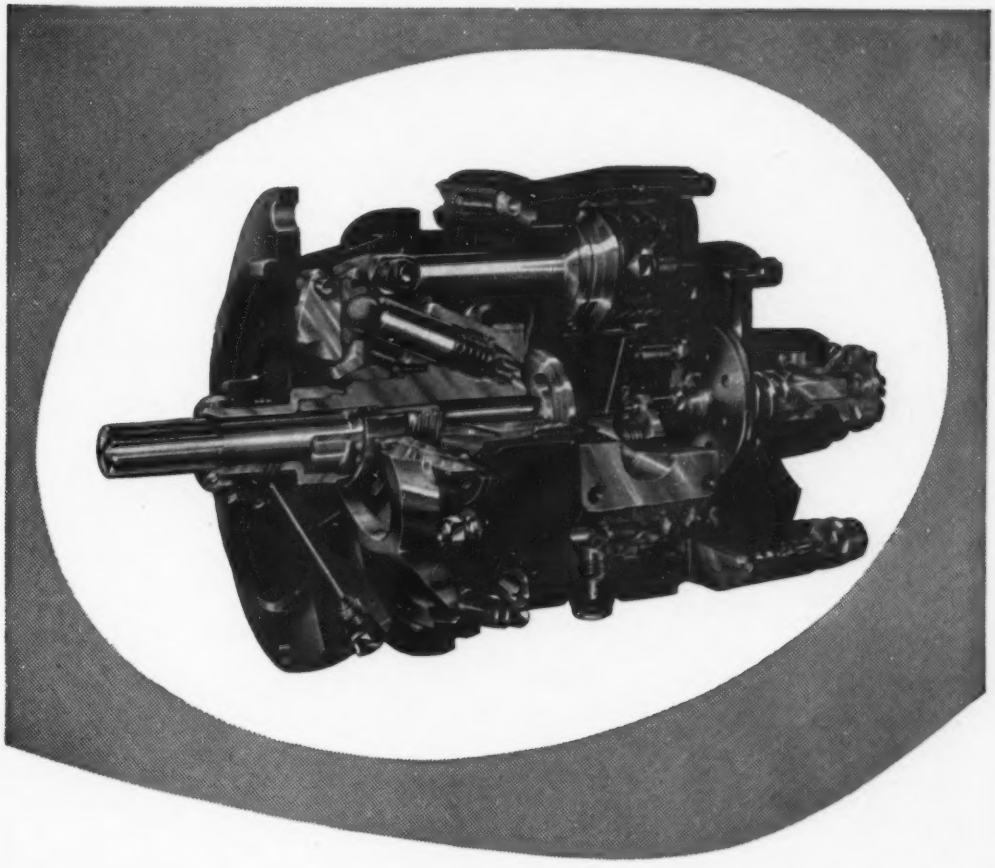

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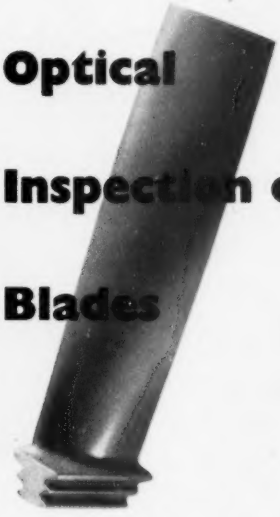

The instrument illustrated makes possible rapid and accurate inspection of the profile and blade angle of compressor and turbine blades. The system is an optical one, and was invented by "Bristol" employees. It gives a magnified image of the blade profile which is compared with a master form traced on a viewing screen (see illustration left). The instrument is housed in a darkened cubicle, and the blade is set up so that the section to be inspected is illuminated by a narrow band of light from six lamps surrounding the blade. A lens near the tip of the blade and co-axial with it, projects the image of the illuminated blade section on to the screen, where it appears as a dark shadow surrounded by a band of light. The magnification may be varied, but is normally 20 diameters so that any errors are easily detected. This is one of many precision instruments used in the manufacture of "Bristol" turbine engines.

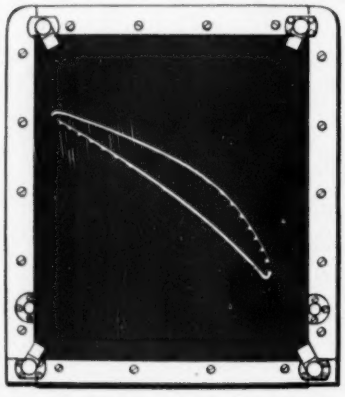

Illustration shows viewing screen with image in white outline and master form in black dash outline.

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